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LIVESTOCK GRAZING MANAGEMENT ON NATIONAL RESOURCE LANDS

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DEPARTMENT OF THE INTERIOR

FINAL
ENVIRONMENTAL STATEMENT

LIVESTOCK GRAZING MANAGEMENT
on
NATIONAL RESOURCE LANDS

Prepared by
Bureau of Land Management
Department of the Interior

Bureau of Land Management
Library
Denver Service Center

Curt Berklund
Director

Bureau of Land Management
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SUMMARY

( ) Draft (x) Final Environmental Statement

Department of the Interior, Bureau of Land Management

1. Type of action: (x) Administrative ( ) Legislative

2. Brief description of the program:

The management of livestock grazing through the application of grazing systems designed to provide a sustained yield of livestock forage consistent with environmental protection and enhancement, including the improvement of rangeland conditions for watersheds and wildlife habitat. About 23,000 livestock operators and approximately 13 million animal unit months annually are involved. It is intended that the program, continued under present trends, will result, by the year 2000, in the implementation of 6,910 allotment management plans, the projected goal of plans required.

3. Summary of environmental impact and adverse environmental effects:

(A) A renewable resource (vegetation) will be harvested under a sustained yield concept. Quality and quantity of vegetation will be improved for wildlife, watershed protection, livestock forage and aesthetic quality. Degradation trends with respect to soil conditions, water quality and vegetative composition will be reversed.

(B) Competition for forage and habitat will continue on areas where livestock, wildlife and wild horses and burros occur.

(C) Fences, water development facilities and certain land treatment practices required for the program will have aesthetic and environmental impacts.

(D) Economics and social stability of dependent rural communities will be enhanced.

(E) Federal expenditures will increase over present levels. However, by 1980, receipts from grazing fees will exceed program expenditures by $5 million annually, increasing to $6 million by the year 2000.

4. Alternatives considered:

(A) Custodial management.

(B) Removal of livestock grazing from national resource lands.

(C) Permit livestock grazing for maximum livestock production on the national resource lands.

(D) Acceleration of the present program by developing and implementing allotment management plans at an increased rate.

(E) No change--maintain existing program with current funding level.

5. Comments have been requested from the following:

Department of Agriculture
*Forest Service
Soil Conservation Service
Agricultural Research Service
Economic Reporting Service
Department of Commerce
Department of Defense
*Environmental Protection Agency
*Atomic Energy Commission
Department of the Interior
Bureau of Indian Affairs
*Bureau of Sport Fisheries and Wildlife
*Bureau of Outdoor Recreation
*Bureau of Reclamation
U.S. Geological Survey
State Clearing Houses
*State of Arizona
*State of California
State of Colorado
*State of Idaho
State of Montana
State of Nevada
*State of New Mexico
State of North Dakota
*State of Oregon
State of South Dakota
State of Utah
State of Washington
*State of Wyoming

6. Date statement made available to CEQ and public:

Draft statement made available to CEQ and public: April 11, 1974

Final statement made available to CEQ and public:

*Comments received

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PART I

DESCRIPTION OF THE PROGRAM

Purpose and Scope

This environmental statement for livestock grazing management has been prepared in accordance with section 102(2)(C) of the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4327). This is a programmatic statement relating to the livestock grazing management program administered by the Bureau of Land Management (BLM) and analyzes the environmental impact of this program on the national resource lands (NRL), public lands administered by the Bureau of Land Management.

This statement will provide a broad description of, and the alternatives to, the livestock grazing management program, and their impacts on the environment. It will serve as the foundation for subsequent environmental analyses and statements that may be required. It will identify factors needing close attention in such analyses to obtain definitive information.

Decisions to prepare environmental impact statements for individual grazing allotments could be based on, but not limited to, such criteria as (1) recognized significant competing uses such as offroad vehicles, wild horses and burros, etc.; (2) conflicts with critical habitat for endangered wildlife species; (3) potential adverse impacts to known wildlife migration patterns as a result of proposed fencing projects; (4) high salinity surface runoff potential; or (5) marginal economic benefits to the livestock operator. Where a major and signficant effect on the environment is determined likely, an EIS will be prepared.

The statement is limited to actions on the NRL in the following states: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, South Dakota, Oregon, Utah, Washington and Wyoming.

Description of the Program

The program analyzed in this statement involves the management of livestock grazing on the national resource lands as one of the multiple use goals and in support of other multiple use goals identified on specific geographic areas through the BLM multiple use planning system. The specific objectives of the livestock grazing management program are to maintain and improve vegetative resources through management actions and supportive measures, to aid biological processes which will result in improved vegetative conditions and greater stability of soil, a sustained yield of livestock forage, more productive wildlife habitat and enhancement of aesthetics. This entails the management of livestock grazing primarily through the implementation of allotment management plans (AMP's). AMP's have been implemented on 25 million acres leaving around 82 percent of the projected AMP acreage remaining to be done in the program. An AMP requires the application of grazing systems so as to achieve and maintain those objectives that are consistent with environmental protection and enhancement.

It is estimated that the program, continued under present trends, will result in the implementation of 6,910 AMP's (total projected need) by the year 2000. It will be mainly financed by allocation of 50 percent of anticipated grazing fees which will reach fair market value by 1980 in accordance with existing regulations. Budget requests for additional funds to supplement grazing fee appropriations are assumed to continue at their present level. This would include funds for watershed and wildlife habitat improvement that can be accomplished through the implementation of AMP's.

The planning system identifies the relationship of livestock grazing to other resource uses and the extent to which livestock grazing will take place in a geographic area. The actions necessary to achieve this desired management of livestock grazing are documented in an AMP which utilizes an interdisciplinary approach. (Refer to Appendix I-A for an example of an AMP.)

Management of livestock grazing includes any one, or any combination of the following practices:

1. Adjustment in numbers of livestock;

2. Changing season, frequency or intensity of livestock use;

3. Changing class of livestock, i.e., sheep, cattle, horses;

4. Deferment of livestock use;

5. Rotation of livestock use;

6. Rest from livestock use;

7. Improved distribution of livestock use;

8. Removal of livestock, temporarily or permanently, partially or wholly, from areas within a grazing allotment where livestock grazing would be detrimental to resource values and uses that through the planning process have been determined to be of higher value in that instance than livestock grazing.

While management actions are common on many allotments where AMP's have not been implemented, it is through the AMP program that this management is systematically developed with multiple resource goals in mind. Development of a prescribed grazing system may include one or several of the preceding practices. For example, a grazing system designed to achieve proper livestock grazing management may require a reduction in numbers of animals, changing class of livestock from sheep to cattle, rotation of livestock grazing use or removal of livestock entirely from a part of the area in order to protect critical wildlife habitat. In certain situations heavy or excessive grazing of some plants may be used as a tool to improve wildlife habitat. The key to successful implementation is that any grazing system must be designed to provide for the continuing physiological needs of desirable vegetation.

The ecological basis for the application of grazing systems on NRL is supported by the potential that exists for improving range condition. The declining condition of millions of acres of rangelands caused by overgrazing during the past century sets the stage for needed improvements.

Scientific research shows that overgrazing has been so widespread that a lessening of grazing intensity or shortening of season of use commonly leads to appreciable improvement (1).

Overgrazed ranges will improve more rapidly with proper livestock grazing than with no livestock grazing (2). Livestock can be used to trample seed into the soil thereby promoting better soil cover and more forage; to remove stifling old growth on plants by grazing, thus increasing plant vigor and production of usable herbage; to stimulate adventitious growth and higher quality forage and to reduce fire hazard.

The supportive measures required to achieve the management goals consist primarily of fencing and water development. Other desirable supportive measures include land treatment practices (spraying, seeding, brush removal, etc.) that would result in optimum benefits to livestock, wildlife and watershed protection. Some level of animal control may be necessary in support of the livestock grazing program. Also some construction of roads and trails will be necessary as a supportive measure. Refer to Table I-1, for a tabulation of existing and proposed supportive measures. The data presented are based on considerations for providing proper distribution of livestock by fencing and water development, improving vegetative composition for livestock, wildlife and wild horses and burros; also to provide access for carrying out management actions and to develop supportive measures for reducing erosion. However, these criteria for employing supportive measures relate only to the livestock grazing program. Additional improvement facilities and supportive measures on the national resource lands would be the result of needs of programs other than livestock grazing.

At the present time, the Bureau of Land Management authorizes grazing on about 150 million acres of the approximate 171 million acres administered in the western United States. Of the 150 million acres, it is estimated that 140 million acres are suitable for livestock grazing and 10 million acres are unsuitable for grazing either because of physical and ecological limitations or because certain lands presently grazed by livestock will be designated for other higher priority uses.

Approximately 15,000 livestock operators hold 15,700 licenses or permits to graze livestock inside 52 grazing districts. In addition, about 8,000 operators hold 8,300 separate leases outside grazing district boundaries. The combined total of licenses, permits and leases is 24,000. Grazing use amounts to approximately 3.5 million cattle and 5.6 million sheep consuming nearly 13 million animal unit months (AUM's) of forage annually. See Table I-2 for the breakdown of existing livestock grazing use by state.

Table I-1

Existing Status and Estimated Quantity of Supportive Measures Needed

for Optimum Development of the AMP Program

Type of Supportive Measure	Existing Quantity[a/]	Needed Quantity[b/]	Total
Fences	28,000 miles	99,000	127,000
Water Developments			
Springs	5,470 each	5,300	10,770
Pipelines	4,300 miles	16,500	20,800
Wells	2,700 each	6,500	9,200
Reservoirs	16,000 each	25,000	41,000
Land Treatment			
Chemical	1,706,000 acres	2,603,000	4,309,000
Mechanical			
Pinon-Juniper chaining	450,000 acres	686,000	1,166,000
Brush removal	201,000 acres	535,000	736,000
Plowing	2,026,000 acres	1,595,000	3,621,000
Prescribed burning	237,000 acres	530,000	767,000
Seeding	3,206,000 acres	2,900,000	6,106,000
Roads & Trails[c/]			
Roads	6,300 miles	5,500	11,800
Trails	3,100 miles	4,050	7,150

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a/ Includes supportive measures on all grazing allotments regardless of AMP status.

b/ Needed quantity of supportive measures are based on estimates subject to revision as data collection is completed, techniques are refined and priorities for expenditure of funds are established.

c/ Also serve other resource use demands such as wildlife, wild horses and burros, hunting, fishing, camping, prospecting, etc.

Table I-2: Operators, Livestock and Feed Use
on National Resource Lands, 1970

State	Livestock Operators	No. Cattle & Horses	No. Sheep & Goats	Cattle & Horses AUM's	Sheep & Goats AUM's	Total AUM's [b/]
Arizona	1,000	224,900	28,500	642,300	2,600	645,000
California	1,000	132,000	260,900	432,300	121,300	553,600
Colorado	2,100	330,400	724,900	468,800	216,000	684,800
Idaho	2,800	358,000	653,800	981,800	276,400	1,258,500
Montana	3,900	615,200	369,700	1,292,100	139,300	1,431,500
Nevada	900	356,000	406,400	1,682,700	353,400	2,036,100
New Mexico	2,900	264,300	211,600	1,696,100	280,300	1,976,400
Oregon [a/]	2,100	278,400	64,400	1,011,500	36,200	1,047,700
Utah	2,600	173,500	1,019,800	629,500	527,300	1,156,800
Wyoming	2,900	721,900	1,523,900	1,172,600	770,700	1,943,300
North Dakota	100	8,200	5,200	N/A	N/A	13,600
South Dakota	300	9,400	24,200	N/A	N/A	71,100
Nebraska	N/A	10,500	100	N/A	N/A	1,500
Total [b/]	23,000	3,484,000	5,617,000	10,010,000	2,724,000	12,820,000

a/ Includes State of Washington
b/ May not add due to rounding

An intensive livestock grazing management program will enable the NRL to contribute to a variety of the Nation's needs such as its red meat supply, numbers and variety of wildlife and quality of water. This will be accomplished by using the grazing allotment management plan concept within the framework of BLM's land use planning system.

The AMP is a concisely written plan for the management of livestock grazing within a multiple use framework (including supportive measures if required) designed to attain specific multiple use management goals in each designated grazing allotment. Steps in development of an AMP are as follows:

1. Preparation of a management framework plan under the Bureau's planning system which involves:

a. inventory of all resources and values;

b. analysis of data to determine potential uses and conflicts among uses;

c. decision as to the use or combination of uses to be authorized within a specific area.

2. Preparation of an AMP as an interdisciplinary Bureau effort in cooperation with the livestock operator authorized to graze in the area, provided that grazing is identified in the management framework plan (MFP) as a compatible use of the area. The AMP includes:

a. a statement of management objectives for all authorized uses (including wildlife, recreation, minerals, etc.) in the area that can be achieved by livestock grazing management;

b. a system for management of livestock use designed to meet the stated objectives;

c. a system of vegetative study methods described in Bureau Manual 4000 for monitoring the plan to insure compliance and measure progress toward meeting the objectives or identifying needed modification in the plan. In addition to range use supervision, this includes range trend and forage utilization studies. Other information such as actual use records and climatological data are important components of the evaluation.

About 25 million acres of the NRL are presently managed under AMP's. The 1,015 AMP's that have been implemented represent an estimated 18 percent of the acreage and 15 percent of the number (6,910) needing to be developed and implemented on the NRL.

Following adoption of the AMP program in 1965, the bulk of BLM's range management effort was directed at the AMP program. As the number of implemented plans increased, the workload for supervision and maintenance of these plans increased which reduced capability to develop and implement new AMP's. As a result, implementation of new AMP's has slowed considerably while the requests for AMP's from livestock operators have grown.

Table I-3 shows by states the number of AMP's in force and the number written but not implemented.

The exact number of AMP's needed will not be known until the broad components of BLM's land use planning are completed; however, the following data indicate the best estimates available at this time:

AMP's estimated required on NRL	6,910[1/]
AMP's implemented through FY 1973	1,015
AMP's remaining to be implemented	5,895
Total BLM acres (excluding Alaska)	171,500,000
Acres estimated unsuitable for livestock grazing	31,500,000
Acres suitable for livestock grazing	140,000,000
Small isolated tracts grazed in conjunction with private lands (no AMP's required)	7,000,000
Acres estimated needing AMP's	133,000,000
Acres with AMP's through 1973	25,000,000
Acres remaining at beginning of 1974 needing AMP's	108,000,000

Of these 108 million acres, about 20 million acres have an adequate level of livestock grazing management now and little change will take place in the type of management recommended as a result of the processes of the Bureau planning system. Another 20 million acres are estimated to need only changes in season of use, class of livestock and portions of allotments excluded from livestock grazing. The remaining 68 million acres will require management actions involving more detailed grazing systems. Grazing on the 7 million acres of isolated tracts, normally located outside grazing district boundaries will continue to be administered on a custodial program subject to environmental safeguards to protect the public interest.

The criteria for developing and implementing AMP's will focus on improving vegetative and watershed conditions. However, this may involve any number of multiple use considerations emerging from the land use planning effort and also on the availability of manpower and funds.

1/ The number of AMP's estimated has been revised downward from the 8,230 estimate presented in the draft environmental impact statement. The primary consideration in revising the numbers is the fact that many individual allotments will be combined into common use allotments that would be more adaptable to rotation grazing systems, and could result in a decrease in total expenditures required if the number of AMP's were higher as shown in the draft EIS.

TABLE I - 3

STATUS OF THE AMP PROGRAM WITHIN THE BUREAU OF LAND MANAGEMENT

(June 30, 1973)

State	TGA [a] Section	Implemented Plans Acreage (1,000's) No.	BLM	Other	Total	Plans Complete-Not Implemented Acreage (1,000's) No.	BLM	Other	Total	Grazing System Only Acreage (1,000's) No.	BLM	Other	Total	Number of Firm Requests for AMP's
Arizona	3	41	1,013	203	1,216	9	340	39	379	-	-	-	-	8
	15	2	40	17	57	1	8	25	33	-	-	-	-	-
	Total	43	1,053	220	1,273	10	348	64	412	-	-	-	-	8
California	3	16	269	45	314	-	-	-	-	4	49	17	66	4
	15	31	368	64	432	1	25	8	33	-	-	-	-	11
	Total	47	637	109	746	1	25	8	33	4	49	17	66	15
Colorado	3	74	1,007	249	1,256	15	282	39	321	1	1	-	1	98
	15	4	13	6	19	-	-	-	-	-	-	-	-	2
	Total	78	1,020	255	1,275	15	282	39	321	1	1	-	1	100
Idaho	3	82	1,987	473	2,460	14	586	65	651	2	76	10	86	121
	15	3	4	5	9	-	-	-	-	-	-	-	-	2
	Total	85	1,991	478	2,469	14	586	65	651	2	76	10	86	123
Montana [b]	3	139	1,262	616	1,878	32	318	123	441	7	40	1	41	75
	15	28	189	171	360	4	18	11	29	6	34	6	40	19
	Total	167	1,451	787	2,238	36	336	134	470	13	74	7	81	94
Nevada	3	87	5,071	601	5,672	16	1,357	108	1,465	2	28	3	31	94
	15	1	660	7	667	-	-	-	-	-	-	-	-	-
	Total	88	5,731	608	6,339	16	1,357	108	1,465	2	28	3	31	94

Table I-3 (continued)

State	TGA Section	Implemented Plans Acreage (1,000's) No.	BLM	Other	Total	Plans Complete-Not Implemented Acreage (1,000's) No.	BLM	Other	Total	Grazing System Only Acreage (1,000's) No.	BLM	Other	Total	Number of Firm Requests for AMP's [d]
New Mexico	3	140	2,159	838	2,997	56	1,051	528	1,579	7	44	9	53	55
	15	2	9	32	41	-	1	-	1	-	-	-	-	-
	Total	142	2,168	870	3,038	56	1,052	528	1,580	7	44	9	53	55
Oregon [c]	3	111	2,320	448	2,768	6	198	38	236	9	292	37	329	39
	15	15	71	181	252	-	-	-	-	4	45	164	209	7
	Total	126	2,391	629	3,020	6	198	38	236	13	337	201	538	46
Utah	3	163	6,929	1,130	8,059	53	1,757	352	2,109	2	159	14	173	21
	15	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	163	6,929	1,130	8,059	53	1,757	352	2,109	2	159	14	173	21
Wyoming	3	67	1,542	433	1,975	6	91	14	105	1	131	5	137	20
	15	9	146	114	260	1	24	4	28	1	1	1	1	4
	Total	76	1,688	547	2,235	7	115	18	133	2	132	6	138	24
Bureau Total		1,015	25,059	5,633	30,692	214	6,056	1,354	7,410	46	900	267	1,167	580

[a] Taylor Grazing Act - Section 3 - lands inside Grazing District boundaries
Section 15 - lands outside Grazing District boundaries

[b] Includes states of North Dakota and South Dakota

[c] Includes state of Washington

[d] represents number of livestock operators who have requested that an AMP be developed and implemented on their allotments

Included in these criteria are: (a) potential for improving or stabilizing the watershed; (b) favorable cost-effect benefits (tangible and intangible) and least-cost factors; (c) allotments where grazing reductions are imminent and the purpose of the AMP would be to prevent the need for reduction in livestock use; (d) implementing a grazing system with specific objectives for improving wildlife habitat; (e) increasing livestock forage production; (f) protecting and improving fisheries habitat; and (g) availability of private funds to invest in range improvements that are necessary components of the AMP.

Although certain rangelands will continue to deteriorate during the interim period, implementation of the AMP program by the year 2000 will result in a reversal of declining trends provided that excessive use by other herbivores is prohibited. This statement is supported by the fact that trend studies conducted on 25 percent of the rangelands covered by AMP's show the trend is improving on 54 percent, indefinite or static on 42 percent and declining on 4 percent (see Table I-4). In comparison the Bureauwide trend report for 1964 as shown in Table I-5 indicated that 17 percent of the rangelands were improving, 69 percent were indefinite or static and 14 percent were declining. A further decline in range condition is expected in the woodland-bushland biome with the present program. It is felt pinon-juniper encroachment and canopy closure is progressing at a rate faster than the treatment rate. This trend could be reversed if a more acceptable method of treatment could be developed.

Application of grazing systems through implementation of additional AMP's would be a process extending over a period of time proposed to culminate by 2000. Generally, a minimum of $30,000 in Federal funds will be required for developing and implementing an AMP. An additional estimated $4,500 of private funds, primarily from range users, would be invested in each AMP. Beyond the investment period, an estimated annual maintenance cost of $1,500 per AMP is anticipated. The degree of cost sharing between Federal and private sources will be guided by the proportion of public and private benefits generated from AMP implementation. Experience has shown that private investments in range improvements by range users for the primary purpose of benefiting the ranching operation, also resulted in some significant benefits to other uses such as wildlife and watershed.

Table I-5 also projects range condition that can be expected for each major biome by the year 2010.

The Taylor Grazing Act of 1934 authorized the Secretary of the Interior to charge a grazing fee for the use of the range. The Secretary can establish the amount of that grazing fee inside grazing districts which, when appropriated by Congress, shall be expended for the range improvement program.2/

2/ On grazing lands outside district boundaries the Secretary of the Interior is required by Section 10 of the Taylor Grazing Act to designate, when appropriated by the Congress, 25 percentum of the grazing fees collected for range improvements.

Table I-4

Range trend data on implemented allotment management plans.[a/]

State	No. AMP's	Improving		Indefinite or Static		Declining		Total
		Acres	%	Acres	%	Acres	%	Acres
IDAHO	21	183,000	56	132,000	41	10,000	3	325,000
MONTANA	130	594,000	64	266,000	28	78,000	8	938,000
NEVADA	20	216,000	70	60,000	20	30,000	10	306,000
NEW MEXICO	30	434,000	67	182,000	28	29,000	5	645,000
OREGON	100	970,000	78	260,000	21	10,000	1	1,240,000
UTAH	61	1,194,000	38	1,856,000	59	100,000	3	3,150,000
TOTAL	362	3,591,000	54	2,756,000	42	257,000	4	6,604,000

[a/] This data is based upon trend studies conducted on implemented allotment management plans which have completed at least one grazing cycle for the six States listed above.

Table I-5

Estimated Forage Conditions as a Result of the Program Projected to 2000 and 2010. [a] (Data derived from literature citations 7-16, page I-29).

Biome and Grazable Acres		Percent in Condition Class Good	Fair	Poor
Grassland				
18,080,000	1964 [c]	31	53	16
	1972 [d]	48	45	7
	2000	60	36	4
	2010 [e]	64	33	3
Desert				
90,476,000	1964	13	51	36
	1972	12	54	34
	2000	32	52	16
	2010	40	50	10
Woodland-Bushland [b]				
29,779,000	1964	14	53	33
	1972	5	47	48
	2000	8	51	41
	2010	8	53	39
Coniferous Forest				
10,582,000	1964	24	57	19
	1972	45	45	10
	2000	57	37	6
	2010	63	33	4

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[a] These estimates are made on the basis of benefits derived from improved grazing management only and do not include additional benefits to forage conditions resulting from mechanical and chemical treatment or prescribed burning.

[b] Little improvement can be expected without supplemental mechanical and chemical treatment, or prescribed burning in this biome.

[c] 1964 data from the Deming Two-Phase method for determining range condition (17).

[d] 1972 data adapted from Forest Resource Report No. 19, The Nations Range Resources, Forest Service, U.S.D.A. 1972. 147 pp.

[e] Figures are projected to 2010 to reflect trend as a result of fully implementing the AMP program by 2000.

Grazing fees established for the use of the NRL varied from 5 cents per animal unit month (AUM) in 1935 to 33 cents in 1968 after which the present grazing fee schedule was implemented. The schedule resulted from a joint Department of Agriculture-Department of the Interior study in 1966 to establish a grazing fee for the public lands based on fair market value (FMV). That study found the FMV in that year to be $1.23 per AUM.

The grazing fee is scheduled for annual increments of 9 cents until 1980 when the FMV adjustment will be fully implemented. In addition, an annual adjustment (plus or minus) is made to reflect the private forage value index.

The 1974 grazing fee of $1 per AUM represents an increase of 22 cents over the 1973 grazing fee. Of the 22 cent increase, 9 cents is scheduled annual increment and 13 cents is the increase in the forage value index.

The range improvement portion of the 1974 grazing fee of $1 per AUM will be 40 cents (or 40 percent) per AUM inside grazing districts. Beginning in 1975, the amount of the annual grazing fee designated for the range improvement fund will be 50 percent. Based on 10.9 million AUM's of forage inside the districts and 1.8 million AUM's of forage outside grazing districts, the range improvement fund for 1975 grazing fees will amount to $5.4 million. Projected to 1980 when the fee schedule will reach fair market value, total annual grazing receipts will be around $26 million with an excess of $12 million designated for the range improvement program including an estimated 20 percent allowance for maintenance of improvements. Table I-6 shows the estimated grazing fee receipts to the year 2000. Table I-7 reflects estimated cost and source of funds for the livestock grazing management program through the same period.

The program of intensive livestock grazing management is premised on grazing use adjusted to the rangeland carrying capacity (or available forage) available for livestock grazing use as determined by range studies. In allocating the carrying capacity for livestock grazing, the reservation of forage is provided for wildlife or wild horse and burro forage requirements.

Based on the Bureau's experience with the AMP program, it is estimated that livestock forage can be increased a minimum of 3.5 million AUM's by implementing the estimated 6,910 AMP's by the year 2000. The previously estimated number of AMP's (8,230 - see Draft EIS) has been revised to reflect recent data which indicates many individual allotments can be combined into common use allotments that would be more adaptable to rotation grazing systems. Experience in the Winnemucca District of Nevada shows an increase of 17,000 AUM's (20 percent) of livestock forage and greatly improved watersheds and wildlife habitat over a period from 1965-1971 on allotments with AMP's.

Table I-8 reflects AUM's of forage for livestock, wildlife and wild horses and burros that can be expected by fully implementing the livestock grazing management program.

Table I-6

Estimated Grazing Fee Receipts and Distribution of Revenue to Range Improvement Fund, United States Treasury and State Treasury [a/]

Year	Grazing Fee $	AUM's (Million)	Total Receipts (Million)	Range Improvement Fund (Million)	U.S. Treas. (Million)	State Treas. (Million)
1974	1.00	12.7	$12.7	$ 4.8	$ 6.2	$1.7
75	1.14	12.7	14.4	6.7	5.9	1.8
76	1.29	12.7	16.4	7.6	6.7	2.0
77	1.44	12.7	18.3	8.6	7.5	2.3
78	1.60	12.7	20.3	9.4	8.4	2.5
79	1.77	12.7	22.5	10.5	9.2	2.8
1980	1.95	13.4	26.2	12.2	10.7	3.3
81				12.2		3.3
82				12.2		3.3
83				12.2		3.3
84				12.2		3.3
1985		14.2	26.7	12.8	11.3	3.5
86				12.8		3.5
87				12.8		3.5
88				12.8		3.5
89				12.8		3.5
1990		14.9	29.2	13.5	11.9	3.7
91				13.5		3.7
92				13.5		3.7
93				13.5		3.7
94				13.5		3.7
1995		15.7	30.7	14.2	12.6	3.8
96				14.2		3.8
97				14.2		3.8
98				14.2		3.8
99				14.2		3.8
2000		16.5	32.2	14.9	13.2	4.0

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a/ Based on 50% of the grazing fee receipts inside grazing districts and 25% of the grazing fee receipts outside grazing districts being designated for the Range Improvement fund.

Table I-7

Estimated Cost and Source of Funds for the BLM Livestock Grazing Management Program

Year	Cost of Program [a] (Million)	Source of Funds [b]		
		Grazing Fees (Million) [c]	MLR Appropriations (Million) [d]	Total (Million)
1975	$ 15.4	$ 6.7	$ 8.7	$ 15.4
76	16.6	7.6	9.0	16.6
77	17.6	8.6	9.0	17.6
78	18.4	9.4	9.0	18.4
79	19.5	10.5	9.0	19.5
1980	21.2	12.2	9.0	21.2
81	23.2	12.2	11.0	23.2
82	23.2	12.2	11.0	23.2
83	23.2	12.2	11.0	23.2
84	23.2	12.2	11.0	23.2
1985	23.8	12.8	11.0	23.8
86	23.8	12.8	11.0	23.8
87	23.8	12.8	11.0	23.8
88	23.8	12.8	11.0	23.8
89	23.8	12.8	11.0	23.8
1990	24.5	13.5	11.0	24.5
91	24.5	13.5	11.0	24.5
92	24.5	13.5	11.0	24.5
93	24.5	13.5	11.0	24.5
94	24.5	13.5	11.0	24.5
1995	25.2	14.2	11.0	25.2
96	25.2	14.2	11.0	25.2
97	25.2	14.2	11.0	25.2
98	25.2	14.2	11.0	25.2
99	25.2	14.2	11.0	25.2
2000	25.9	14.9	11.0	25.9
TOTAL	594.9	321.2	273.7	594.9

[a] Does not include direct cost of other range management programs, e.g. wild horses and burros.

[b] Does not include funds from private sources for range improvements.

[c] Increase in grazing fee receipts to 1980 reflects full grazing fee schedule after 1980, increased receipts reflect upward trend in forage production.

[d] Congressional appropriations for management of lands and resources.

Table I-8

Present Status and Projected Total Animal Unit Months (AUM's) of Forage for Livestock, Wildlife and Wild Horses and Burros as a Result of Fully Implementing the AMP Program.

Class of Animal	Animal Unit Months 1972	2000	2010
Livestock	13,000,000	16,500,000	18,700,000
Wildlife[a/]			
Antelope	182,000	214,000	240,000
Deer	1,647,000	1,945,000	2,175,000
Elk	277,000	326,000	365,000
Bighorn Sheep[b/]	15,500	18,200	20,400
Other Mammals[b/]	21,000	24,700	27,700
Wild Horses	204,000[c/]	204,000	204,000
Wild Burros	47,500[c/]	47,500	47,500
Total	15,394,000	19,279,400	21,779,600

[a/] Converted to livestock AUM's. The rationale for the projected increase to wildlife AUM's that would result from improved livestock grazing management is as follows: The BLM 1971 Annual Wildlife Report indicates that 44 percent (46,000,000 acres) of 104,000,000 acres of big game habitat has been determined to be in unsatisfactory condition. Under the AMP program, wildlife habitat would receive the management necessary for its improvement and maintenance, such as heavy grazing of grass species by livestock at crucial periods resulting in an increase of browse or forb species preferred by wildlife. (See page III-22 for further discussion.) The projected increase in AUM's is about 31 percent. From a professional judgment standpoint, this is believed to be a modest projection.

[b/] Includes only recognized game species.

[c/] Based on 1971 estimates.

History and Background

Before the settlers arrived in the western United States, natural ecosystems existed throughout the area. Within some of these ecosystems were large herds of herbivores such as bison, antelope and elk. There were no man-made barriers to restrict their free movement and, as a consequence, these animals moved at will. When food or water became scarce in an area or seasonal climatic changes dictated, the animals moved to a new range or suffered increased mortality.

The ecosystems of the western United States have developed under grazing and trampling pressure of ungulates that have consistently been a component of these ecosystems. During the exploration period of the West, the western rangelands were recognized as having a great potential for livestock production. As a result, many large-scale livestock operations created significant vegetative changes in the range ecosystems that were to increase in subsequent years. The transition from wildlife to domestic livestock upset the natural ecosystem, not because of the difference in the grazing animals, but because of the increased numbers, wrong seasons of use, confinement and losses in available grazing areas caused by homesteading, urban expansion and other development.

During the 19th and 20th centuries, as the human population increased and settlement expanded westward, numbers of livestock in the West also increased replacing the native herbivores in the ecosystem. Bison populations were sometimes deliberately decimated to reduce their competition with livestock and also to eliminate food sources of those Indians dependent on wildlife for their existence.

The range ecosystems that once supported an incredibly vast number of large herbivores as well as smaller wildlife forms underwent some drastic changes in vegetation composition because of the grazing habits and the confinement of the domestic livestock within man-made barriers. In addition, thousands of acres of the range ecosystems were being converted to farmland, thereby significantly reducing the size of the original range ecosystems. For example, nearly 200 million acres of the tall grass prairie were converted.

Through the various activities of man, many ecosystems underwent deterioration because of the loss of the productive topsoil through accelerated wind and water erosion. By 1900, the productive capacity of the area that was to become the NRL of today had been greatly reduced (3).

The expansion of the railroads into the western United States helped supply increased demands for meat in the East. The railroads expanded the marketability of western beef and increased the interest in livestock production on western rangelands.

During this period, there was a growing concern among the users of the western rangelands over the destructive use being made of the lands (4). Migrant sheep herds were moved from range to range and were often in direct competition with local sheep and cattle for forage of the national resource lands. The local stockmen, through homesteads and other land and water acquisitions, had established operations with designated geographic areas and attempted to exert control of the national resource lands through registration of water rights, herding laws and the like (5). Insufficient rangeland and inadequate forage production failed to sustain the livestock industry that had developed. Also, though it may have helped little in view of the competitive relationships that existed at that time, the level of knowledge about man's impact by livestock grazing on the range ecosystem was lacking during this period. Related research was nonexistent.

Rangeland conditions became critical during the early 1930's, and in 1934, the Taylor Grazing Act was enacted by Congress. (See Appendix I-B.) The purpose of this Act was to stop injury to the national resource lands resulting from unrestricted grazing; to provide for their orderly use, improvement and development; and to stabilize the livestock industry depending on the national resource lands.

To implement the Taylor Grazing Act, a Division of Grazing was established within the Department of the Interior. Regulations to put the Taylor Grazing Act in force became known as the Federal Range Code.

The initial job of the 47 field personnel in the Grazing Service was to divide the national resource lands for use by qualified livestock operators in accordance with recognized grazing qualifications. With minimal funds and manpower to administer the Federal range during the early years of the Grazing Service, the District Advisory Boards that were organized pursuant to the Act provided valuable assistance to field personnel in matters affecting grazing administration. Livestock operators contributed time and money to bring about orderly administration and to develop range improvements.

With initial emphasis on basic allocation of grazing privileges, there was little attempt during this period to adjust grazing use to the ability of the land to sustain grazing. The extent of the grazing privileges issued was based primarily on the use made by the livestock operator during the 5 years prior to the passage of the Taylor Grazing Act and on the applicant's control of either private land or water.

There was little broad public interest in the condition of western rangelands at this time. Minimal congressional funding to implement the Taylor Grazing Act was proof of this public apathy. In addition, Grazing Service officials played down the need for realistic funding.

The Grazing Service and the General Land Office were combined to form the present Bureau of Land Management (BLM) in 1946.

Increasing awareness of resource management needs, as a result of studies revealing the extent of poor condition of the land, led to increasing emphasis for better management. By 1950, appropriations had increased sufficiently to allow BLM to hire additional professional range conservationists for the range management program. Inventory of the range forage resource began for the first time which enabled the range manager to calculate the number of livestock that could properly graze an area.

Based on these studies, ranchers were allocated certain areas with a given number of animals during a given season of use. These decisions often conflicted with the rancher's historic use of the range and required a reduction in livestock use, which did not always stop range deterioration. This range adjudication process often resulted in lengthy legal proceedings during which the grazing continued.

In 1964, Congress demonstrated its intent to have the NRL managed under the multiple use concept by passing the Classification and Multiple Use Act of 1964 (78 Stat. 986). This Act directed the Secretary of the Interior to establish criteria by which he would determine which lands administered by him through the BLM will be disposed of, or retained in Federal ownership and managed for their multiple use values, including: (a) domestic livestock, (b) fish and wildlife, (c) industrial development, (d) mineral production, (e) occupancy, (f) outdoor recreation, (g) timber production, (h) watershed protection, (i) wilderness preservation and (j) preservation of public values. For the first time Congress clearly indicated that some NRL should be retained in Federal ownership. Figure I-1 shows the location of the principal concentrations of the 171,500,000 acres of NRL in the western United States.

Also, in 1964, Congress created the Public Land Law Review Commission which was charged with making recommendations for the future management of 725 million acres of Federal lands, including all of the NRL. The commission report, delivered in 1970, contained 137 recommendations of which nine were specifically directed at new policy and direction for the future management of livestock grazing on the Federal lands under study (6). All of the nine recommendations contemplated continued use of the Federal lands for livestock grazing, but so far no legislation has been passed to implement the livestock grazing recommendations.

By 1965, the majority of range adjudications were complete and BLM management efforts were directed toward the development of a more intensive form of livestock grazing management. This was the beginning of the allotment management plan program, which today has gained broad acceptance by livestock operators, game management agencies and conservation groups.

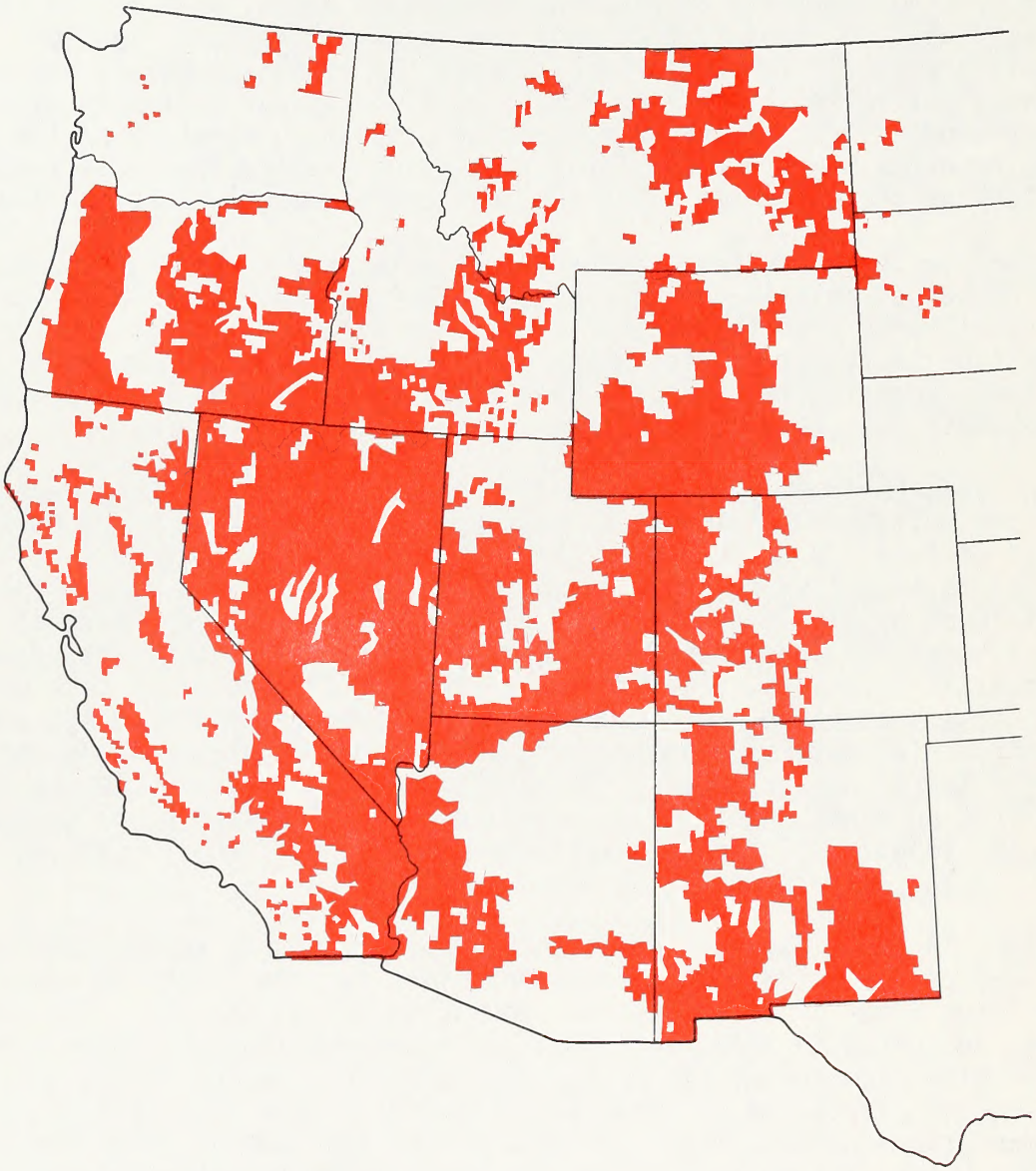


Figure I-1 Major Concentrations of National Resource Lands
Administered by the Bureau of Land Management

The livestock grazing management program of BLM represents only one activity or use that may be occurring at the same time in the same area. Each area may, in addition to grazing, include mineral operations, watershed management, wildlife management, recreation, timber management and public uses such as utility right-of-way, sanitary land fills and communication sites. Individually, each use produces impacts on the ecosystem. Collectively, these activities could produce a total effect that exceeds the ecosystem's capacity to sustain itself or to recuperate.

Criteria exist for measuring such items as the carrying capacity of a livestock range or the allowable cut of a forest. Fragmented analyses of individual resource activities have little meaning, however, unless their relationship to total impacts is understood, and the analyses are used to formulate multiple use programs that do not overtax the ecosystem.

In 1964, BLM started developing a planning process to better determine which land use, or combination of land uses, can take place on an area. After a period of design and testing, the BLM planning system was adopted and implementation started in July, 1969. This system is presently being used to develop and maintain land use plans which consider all of the various resource uses for all national resource lands.

The BLM planning system is similar to traditional planning approaches. It includes such usual components as goals, objectives, inventory of physical resources, socio-economic data and public participation. However, it differs in several ways. It has techniques requiring the description and comparison of "trade-off" and what is gained or lost when decisions are made to accept various alternatives. Another major departure from traditional planning philosophy is the concept and requirement of assessing the single use potentials of each physical resource.

In brief, the system works as follows (for detail refer to BLM Manuals 1601-1608). The first step in the procedure is to delineate the BLM-administered land into geographical areas called planning units. These units serve as the basis for collection and analysis of basic resource inventory data. In some cases, the planning units are combined into planning areas for purposes of preparing the management framework plan (MFP). Under the BLM system the MFP is the land use plan. Unit resource analyses (URA) are prepared for each planning unit. The URA includes a detailed description of the existing environment of the planning unit, a physical inventory of individual resources (lands, minerals, livestock forage, forestry, recreation, wildlife, watershed) and an analysis of the resource production opportunities without multiple use consideration.

After URA's are completed, an MFP is prepared for a planning area. This area may cover one or more planning units. Basically, the MFP is the result of a process designed to identify and reconcile major land and resource use conflicts. The MFP provides a set of goals, objectives and constraints for a specific planning area to guide the development of detailed plans for the management of each resource. It is prepared using

an interdisciplinary approach at the field level by BLM employees. Coordination with a variety of groups and interests is obtained in an organized public participation process.

As of July, 1974, MFP's have been completed on about 50 percent of the NRL. By July, 1976, it is estimated that MFP's will be completed on 80 percent of the NRL and by 1980 all NRL will be covered by MFP's.

The MFP for a specific planning area describes the various resource uses that are permissible after consideration of BLM policy guidance, the facts about the resources and uses, views of the public and other inputs to the decision-making process. In addition, the MFP describes the constraints on planning necessary to ensure compatibility of uses, protection and enhancement of the environment and other management objectives.

The MFP process requires three steps. Step 1 is the development of a set of recommendations showing the optimum use and/or development for each resource, constrained only by the resource capability, the limiting effects of policy and social and economic data as provided by other components of the planning system. Step 1 also includes environmental enhancement and protection recommendations. Step 2 covers conflict resolution and development of alternatives to solve or minimize the conflicts. This step makes alternative multiple use recommendations for the planning area, thereby resource use conflicts are resolved and constraints are established to guide management of each resource. The final step involves the decision-maker's selection of a set of alternatives to guide future programs. The decision-maker is guided by policy and public views. Public involvement in developing MFP occurs at all steps, beginning with URA.

BLM policy is that significant changes in grazing management will not be made until the MFP is completed. This is to allow proper consideration of other resource values. However, where environmental analyses or studies indicate areas are deteriorating significantly due to improper livestock grazing, or because of drought, practices or decisions needed to halt resource degradation may be implemented at once. These actions are not restrained by completion of planning except that irreversible actions to halt deterioration will not be taken without an MFP.

To illustrate, current grazing management will be subject to review as MFP's are completed. The following are some actions which could result from an MFP: Grazing boundaries could be adjusted; allotments could be consolidated or eliminated in such areas as frail land or important wildlife habitat; leases could be eliminated; areas could be identified as unsuitable for grazing because of soil damage or conflicts with an intensive recreation use; or forage production could be increased.

Following approval of the MFP by BLM, and subject to available funds and manpower, program activity plans are prepared for each resource activity, to lay out in detail how each activity will achieve the objectives and meet the constraints shown in the MFP. The program activity plan for grazing management is the AMP. The BLM planning system represents the process by which many of the mitigative measures described in Section IV are prescribed for use in any particular area.

The BLM's authority to administer the grazing program on the national resource lands is as follows:

a. Taylor Grazing Act. The Act of June 28, 1934 (48 Stat. 1269; 43 U. S. Code 315, as amended).

b. O. and C. Act of 1937 (50 Stat. 874; 43 U. S. Code 590a 118).

c. Soil Conservation and Domestic Allotment Act (Act of April 27, 1935, as amended; 16 U. S. Code 590a-590q-1 (1964 and Supp IV 1965-1968)).

d. Bankhead-Jones Farm Tenant Act (Act of July 22, 1937, 7 U. S. Code 1010-13a, 1964).

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(12) Leithead, H. L. Grass Management Pays Big Dividends. J. Range Management 13:206-210. 1960.

(13) Johnson, W. M. Rotation, Rest-Rotation, and Season-Long Grazing on a Mountain Range in Wyoming. U. S. Forest Service Research Paper RM-14. 1965. 16 pp.

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PART II

DESCRIPTION OF THE ENVIRONMENT

Grazing of domestic livestock affects the surface environment, and to a lesser degree, the subsurface environment. The impact of grazing on the surface environment depends largely on the ecological relationships that have developed in the area. The surface environment is described for each of the four major biological communities, or biomes, in the western United States. The locations of the biomes are shown in Figure II-1.

This statement relates only to national resource lands within each biome. The extent of livestock grazing on NRL within a biome will depend on the amount of NRL in the biome, the type and amount of the vegetation available for forage and the demand for livestock forage.

Biomes are major biotic communities or natural groups of organisms, characterized by certain "dominant" and "influent" plants and animals (1). Four major biomes were outlined for this statement.1/ An attempt has been made to indicate the boundaries between the biomes. However, the biomes are really separated by transitional zones or ecotones, where elements of adjacent biomes blend.

The four biomes described in this statement include both aquatic and terrestrial communities. They also contain biological islands more characteristic of other biomes. The islands are caused by geographical, climatic, altitudinal and other variations within the broad areas delineated on the maps.

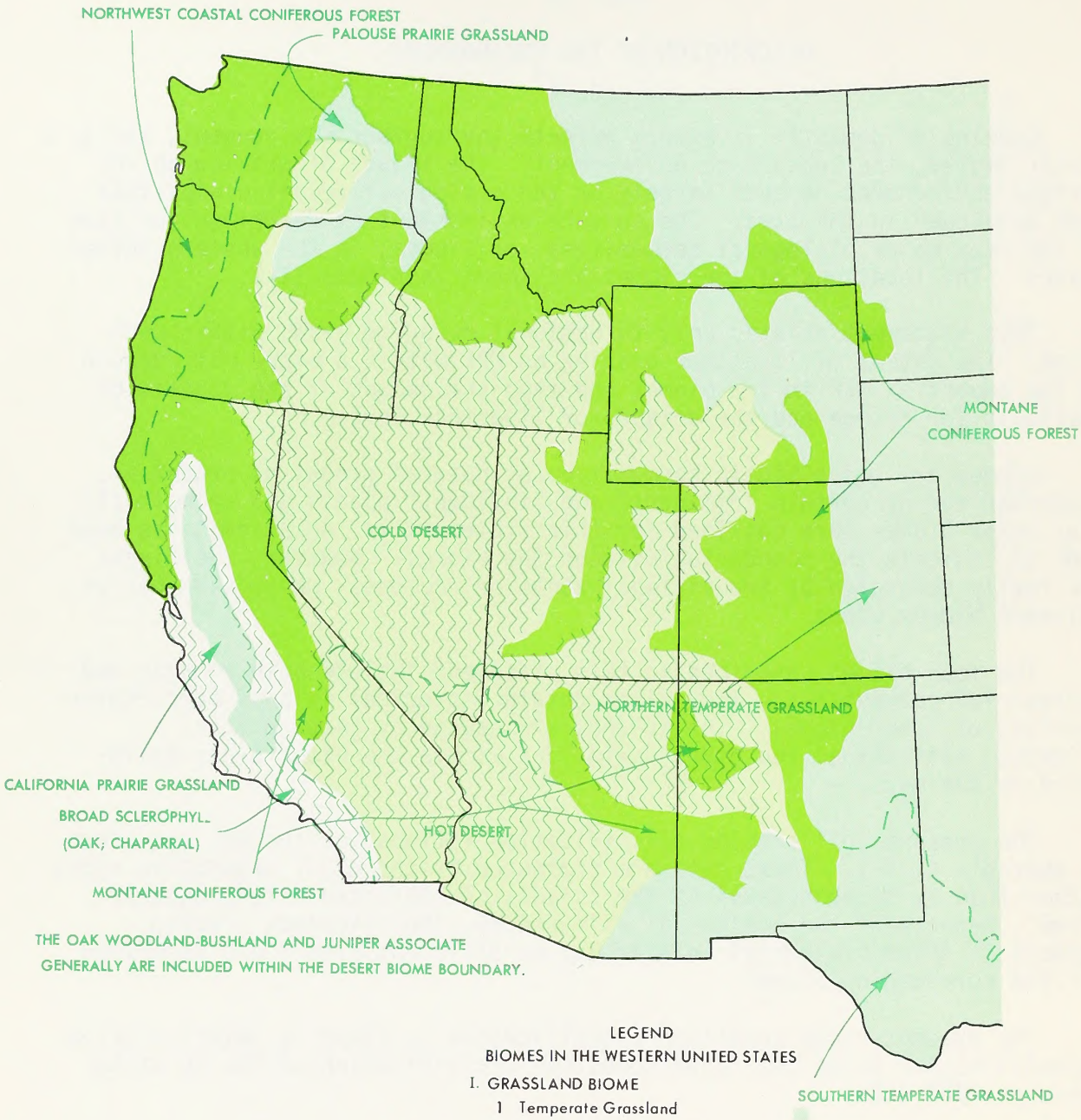
The present soil erosion classification ratings for the NRL are shown in Appendix II-A-1. These data are presented by the major vegetative types rather than by biome because of the islands of one biome within another biome. Because of the ecological differences, the livestock grazing impacts in these biological islands may be different from those described for the surrounding biome.

The present range condition classification by biome is detailed below. Appendix II-A-2 shows the range condition classification of NRL by state based on 1964 data.

Overview of the Four Biomes

The four major biomes described in this statement are the (a) grassland, (b) desert, (c) woodland-bushland and (d) coniferous forest.

1/ International biome programs (IBP) have been initiated to analyze basic ecosystems of three of the biomes delineated in this statement. One of the goals of the IBP is to maintain or improve environmental quality.



(*Generally included within the desert biame baundary.)

FIGURE II-1 BIOMES OF THE WESTERN UNITED STATES (1)

Only two of the sub-biomes of the coniferous forest biome will be discussed. These are the northwest coastal and the montane coniferous forest sub-regions. The broad characteristics of the biomes are summarized below. More detailed descriptions are included in the following sections of Part II.

Grassland Biome

Grasslands occur where precipitation is too low to support forest life forms, but higher than that resulting in desert life forms. Soils are quite diverse, reflecting characteristics of the underlying parent material; they contain large amounts of humus. The larger forms of both native and domestic grazing animals are dominant. A large proportion of the mammals are running or burrowing types (2). Much of the grassland is used for agricultural cropland and domestic livestock grazing.

Within this biome there are 18,080,000 acres of national resource lands, all of which are considered to be usable by livestock.

Information derived from the 1964 range condition and trend survey, which is the latest data available, indicates the following condition:2/

2 percent in excellent condition

29 percent in good condition

53 percent in fair condition

14 percent in poor condition

2 percent in bad condition

There were 2,214,000 acres of the NRL in the grassland biome with an improving trend, 2,726,000 acres in a declining trend, with the balance of 13,140,000 usable acres in an indefinite or static trend.

Desert Biome

Deserts are shrub-vegetated ecosystems generally occurring in regions with less than 10 inches of annual precipitation and marked extremes in weather. The vegetation is adapted to aridity, and bare earth is common; little humus is formed. Hot deserts generally are warm throughout the year and very hot in summer. The cold desert is very cold in winter. Animals are adjusted physiologically or in habits of life to tolerate the arid environment (3). Most of the area remains essentially in its native vegetative state and is used primarily for livestock grazing. Outdoor

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2/ Range condition and trend data is based on acres usable for livestock grazing. Present plans call for an updating of the range condition and trend data beginning in fiscal year 1975. (See BLM Manual, Volume IX, part 10, "Studies.")

recreation is an increasingly important land use in the biome. Within this biome there are about 102,720,000 acres of national resource lands of which 90,476,000 are considered usable by livestock. Information derived from the 1964 range condition and trend survey indicates the following condition:

1 percent in excellent condition

12 percent in good condition

51 percent in fair condition

30 percent in poor condition

6 percent in bad condition

There were 15,405,000 acres of the NRL with an improving trend and 13,353,000 acres with a declining trend, with the balance of 61,718,000 usable acres in an indefinite or static trend.

Woodland-Bushland Biome (3)

Woodland-bushland communities generally occur as biological islands at higher elevations in the desert and grassland biomes or in ecotones or transitional zones, between the desert or grassland biomes and the coniferous forest biome. Vegetative cover ranges from shrub species typical of the cold desert to brush and small tree species in areas with greater precipitation. A diversity of plant species and climatic conditions exists among the subregions of the biome. Animal populations are also diverse and include many small reptilian species, rodents, small predators, larger browsing mammals and a wide range of bird species.

Predominant land uses in this biome are similar to those in the desert, grassland or coniferous forest biome. Within this biome there are about 30,700,000 acres of NRL of which 29,779,000 acres are considered usable by livestock. Information derived from the 1964 range condition and trend survey indicates the following condition:

2 percent in excellent condition

12 percent in good condition

53 percent in fair condition

28 percent in poor condition

5 percent in bad condition

There were 5,062,000 acres of the NRL in the woodland-bushland biome with an improving trend, 4,169,000 acres in a declining trend, with the balance of 20,548,000 usable acres in a static or indefinite trend.

Coniferous Forest Biome

The coniferous forests contain a diversity of environments, species compositions, soils, resource products and land uses. Precipitation in most of the biome is high, and the forests have a great capacity for vegetative growth; they are used primarily for wood and water production. However, the effects of urban expansion are being felt on an increasing level on all forested areas; hunting, fishing, sightseeing and general recreation use is becoming more significant in the biome. Much of the land surface in the biome is federally owned. Within this biome there are about 20,070,000 acres of NRL of which 10,582,000 acres are considered usable by livestock. Information derived from the 1964 range condition and trend survey indicates the following:

2 percent in excellent condition

22 percent in good condition

57 percent in fair condition

17 percent in poor condition

2 percent in bad condition

There were 1,887,000 acres of the NRL in the coniferous forest biome with an improving trend, 1,407,000 acres in a declining trend, with the balance of 7,288,000 usable acres in a static or indefinite trend.

General Environmental Characteristics of all Biomes

Grazing and Vegetation Relationship

The following discussion of the interrelationship of grazing and vegetation is largely quoted, with minor modifications, from Lewis (4).

Overgrazing by domesticated animals was one of the first destructive changes produced by man in his environment. Similar patterns of degradation have been observed on every continent (5, 6, 7). Widespread alarm over range deterioration resulted in the establishment of grazing studies in the western United States beginning in 1895 (8). The literature on the influence of grazing on plant succession of rangelands was reviewed by Ellison (9). The effect of defoliation on individual plants was reviewed by Jameson (10). The process of rangeland deterioration induced by grazing is summarized in the following paragraphs.

Overstocking with grazing animals results in overuse of the vegetation and increased mechanical injury due to trampling and increased soil disturbance and compaction (11). Although slight disturbance of the habitat that occurs under normal stocking rates may diversify the habitat and make it more favorable for other herbivores, overstocking is destructive (12).

Overuse of a plant population by clipping or grazing results in reduction in root growth and smaller, less extensive root systems (13, 14). Other effects from overuse are reduced rhizome production; reduction in labile carbohydrates, proteins and other substances (15, 16, 17). Slower regrowth and reduced foliage and seedstalk production also result from plant overuse by grazing (9, 10).

Plants selectively grazed are less able to compete for water and nutrients than those that escape grazing. Grazing animals select those plants and parts of plants that are most palatable and most accessible to them at a given time. They graze first in convenient areas near water, their bedgrounds and loafing areas. Different kinds of grazing animals prefer different areas in a pasture and have a different order of preference for plant species at different seasons. The mechanism of herbage selection is not well understood. However, palatability appears to be related to succulence and sweetness which are directly related to high nutritional value (18). Other factors being equal, consumption is proportional to the availability. Plants escape grazing because of low palatability, presence of armor, short or very tall growth form or because their life cycle is completed at a time other than the grazing season.

Plants resistant to grazing are damaged less by close use and thus are better able to compete for water and nutrients than those easily damaged by grazing. One characteristic that makes a plant more susceptible to grazing damage is attaining a height within reach of grazing early in the season (19, 20). A high ratio of fruiting to vegetative stems, a lack of vegetative means of reproduction, a low capacity to tiller, slow regrowth following grazing, less extensive root system with a slower rate of root growth, lack of drought resistance, lack of adaption to the site and a high susceptibility to parasites and disease are additional factors of plants which make them more susceptible to grazing damage (21).

With prolonged use, plant species that are susceptible to grazing damage and are selectively grazed (decreasers) will be weakened and replaced by those species that escape grazing or are more grazing resistant (increasers). Those less palatable species and biotypes not selected by the grazing animals survive (22, 23). As the decreasing plant species become smaller and less abundant, they are less actively sought by grazing animals, thus permitting some individuals of these decreasing species to remain for many years (24). As relative palatability and availability change, some of the increasers receive more grazing pressure, and thus are replaced by increasers less likely to be grazed and still more grazing resistant (25). As the integration of the plant community is destroyed, exotic plant species, or those not originally present except on disturbed areas, are able to invade and spread over the range (26). These invading species are usually capable of rapid migration, adaptable to a drier habitat and either very resistant to grazing or escape grazing. As the botanical composition changes under the impact of grazing, the delicate adjustment of interacting plant populations and their adaption to the environment is disrupted. Thus, overstocking that is not corrected

produces overuse which, over a period of years, is reflected in changes in the kinds and amounts of vegetation (27). Range condition, determined by the degree of departure from the climax plant community, is a quantitative measure of the estimate of this departure (28, 29). As a range deteriorates under one kind of grazing animal, it often becomes more desirable for herbivores with different grazing habits and different forage preferences. This may result in a change in populations of small mammals and invertebrates. Where extreme overuse is continued for many years over large areas in relatively dry climates, desert conditions may be induced.

The destructive changes in rangeland resources caused by overgrazing do not occur on well-managed grazed lands. The natural state in rangelands was reached and maintained under grazing. While Ellison found no published data proving the beneficial effect of grazing, he concluded that such evidence will likely be found (9). Under judicious management, grazing can stimulate tillering, maintain a high proportion of new leaves to older tissue and accelerate nutrient cycling. If these advantages can be accomplished without reducing the competitive ability of the most productive plant species and without appreciable desiccation of the habitat, grazing can increase net primary production.

Uncontrolled populations of wild ungulates, lagomorphs, rodents and grazing insects result in the same process of induced regression described above and are just as damaging to net primary production as overgrazing by livestock. Habitat destruction has been documented for deer in Utah and on the Kaibab Plateau in Arizona (30, 31). Similar documentation exists for habitat destruction by the Gallatin elk herd in Montana (32).

Overgrazing and habitat destruction may be made more severe by competition between domestic animals and wild herbivores (33). In the trans-Pecos region of Texas, pronghorns grazing on a drought-stricken range heavily stocked with cattle and horses were forced to subsist almost entirely on three unpalatable browse species that were available on the depleted range. As a consequence, 57 percent of the herd died from malnutrition and tarbush poisoning (34).

Ecological Interrelationships

Ecological interrelationships deal with the interworkings between all living and non-living components. Plant and animal communities and populations as a whole are regarded in relation to one another and to the total environment. The ecosystem is examined, with its interwoven energy and material pathways, the growth and interaction of its populations, their evolution and behavior, their environmental relations and feedback mechanisms, and the structure, functions and development of communities. These interrelationships are illustrated in a common food chain such as grass-cow-man.

Generally, more is known about the terrestrial community than the aquatic community. Knowledge of the aquatic community and the cumulative and collective effects of human activities has increased rapidly in recent years.

Nutrient Cycles

Such elements as nitrogen, oxygen, phosphorus and potassium are essential elements in the maintenance of life on earth. These and other nutrients continuously circulate through the environment in fixed patterns or cycles, and in the process are made available in various forms to man and animals (consumers). For example, nitrogen is recycled from plants (producers) to animals (consumers) to the atomsphere and back in the following process. Microorganisms (decomposers) convert organic material into inorganic ammonia, nitrites and nitrate. The nitrate, if not taken up by other plants or stored in the soil, is then denitrified; and the nitrogen is returned to the atmosphere as gas, where it again is available to nitrogen-fixing plants. The nitrogen taken up by plants moves into the bodies of grazing animals principally as proteins and back into the soil as excreta or upon decomposition of the animal after death (see Figure II-2).

Under natural conditions, nutrient cycles are more or less in dynamic balance. Agricultural activities remove nutrients in the form of crops, and grazing removes nutrients in the form of animals, disturbing the natural dynamics.

Many different nutrient cycles occur--little is known about many of them. However, the more perfect cycles have so many compensating mechanisms that apparently man has not significantly modified them. Disturbance or manipulation of a cycle involving a vital element, however, could disturb it beyond its compensatory powers and cause its complete collapse (2).

Energy Flows

Energy flows through the ecosystem, it does not cycle (3). The pathways of energy flowing through a terrestrial ecosystem are shown in Figure II-2. Energy from the sun is used by plants, and through the process of photosynthesis they convert solar radiation into plant material. Herbivores, carnivores and omnivores, in turn, feed on plants and other animals to acquire energy. Bacteria, fungi and some animals derive energy as they decompose dead organisms. Energy is continuously being used by the organisms and new energy is continuously being acquired from solar radiation.

Hydrologic Cycle

The movement of water into, through and eventually out of an ecosystem is a major stimulus in the functioning of the system. The cycling of water consists of precipitation inputs, runoff outputs and a series of intermediate processes influencing the precipitation/runoff relationship.

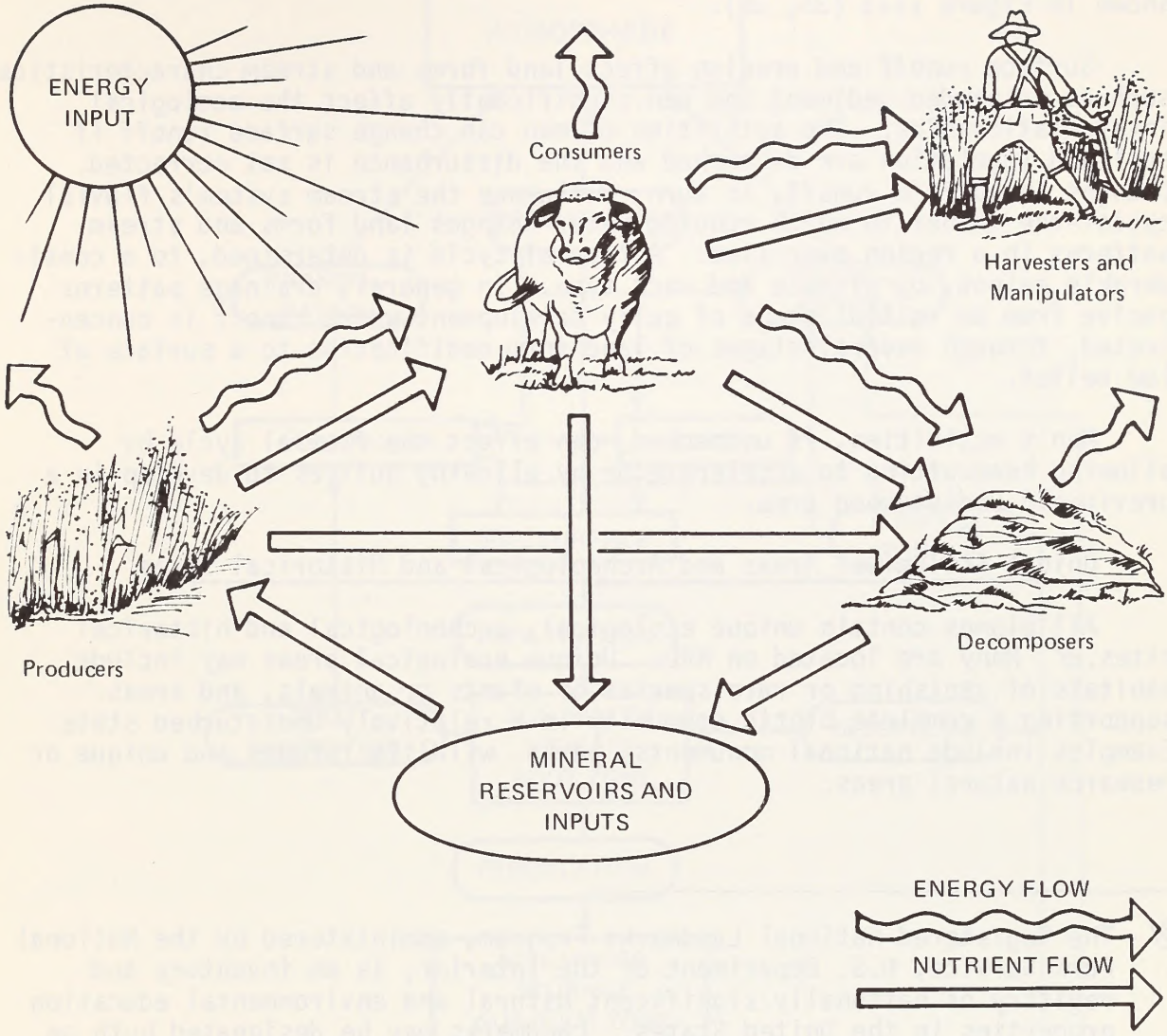


FIGURE II-2 A SCHEMATIC ILLUSTRATION OF PATHWAYS OF FLOW OF ENERGY AND MATTER THROUGH A TERRESTRIAL ECOSYSTEM.

SOURCE: Van Dyne, G.M. 1969. "Some Mathematical Models of Grassland Ecosystems," P. 6, in R.L.Dix and R.G.Beidleman (ed.), "The Grassland Ecosystem : A Preliminary Synthesis." Range Science Department Science Series No. 2, Colorado State University, Fort Collins, Colorado.

The intermediate processes include interception, infiltration, percolation, evapotranspiration, surface runoff and storage. The hydrologic cycle is shown in Figure II-3 (35, 36).

Surface runoff and erosion affect land forms and stream characteristics such as suspended sediment and can significantly affect the ecological interrelationships. The activities of man can change surface runoff if soil and vegetation are disturbed and the disturbance is not corrected. Changes in surface runoff, in turn, influence the stream system's fluvial cycle--the manner in which running water changes land forms and stream patterns in a region over time. A fluvial cycle is determined, to a considerable extent, by climate and rock type. In general, drainage patterns evolve from an initial stage of gully development where runoff is concentrated, through several stages of land form modification to a surface of low relief.

Man's activities, if unchecked, can affect the fluvial cycle by allowing headcutting to accelerate or by allowing gullies to develop in a previously undisturbed area.

Unique Ecological Areas and Archeological and Historical Sites

All biomes contain unique ecological, archeological and historical sites.3/ Many are located on NRL. Unique ecological areas may include habitats of vanishing or rare species of plants or animals, and areas supporting a complete biotic community in a relatively undisturbed state. Examples include national monuments, parks, wildlife refuges and unique or research natural areas.

3/ The Registered National Landmarks Program, administered by the National Park Service, U.S. Department of the Interior, is an inventory and registry of nationally significant natural and environmental education properties in the United States. Landmarks may be designated both on public and private lands. Landmark designation does not affect ownership or the responsibility of the owner for the property. Designated landmarks are listed in National Parks and Landmarks, available from the U.S. Government Printing Office. On January 1, 1972, there were 936 historic landmarks, 167 natural landmarks and 11 environmental education landmarks in the registry. The National Register of Historic Places should be consulted to determine if historical properties are affected by the livestock grazing management program. Compliance is required with Section 2 (b) of Executive Order 11593 of May 13, 1971. This will be done incrementally through the allotment management plan process. Where archeological values are concerned, serious consideration should be given to preservation of such resources as opposed to merely salvage.

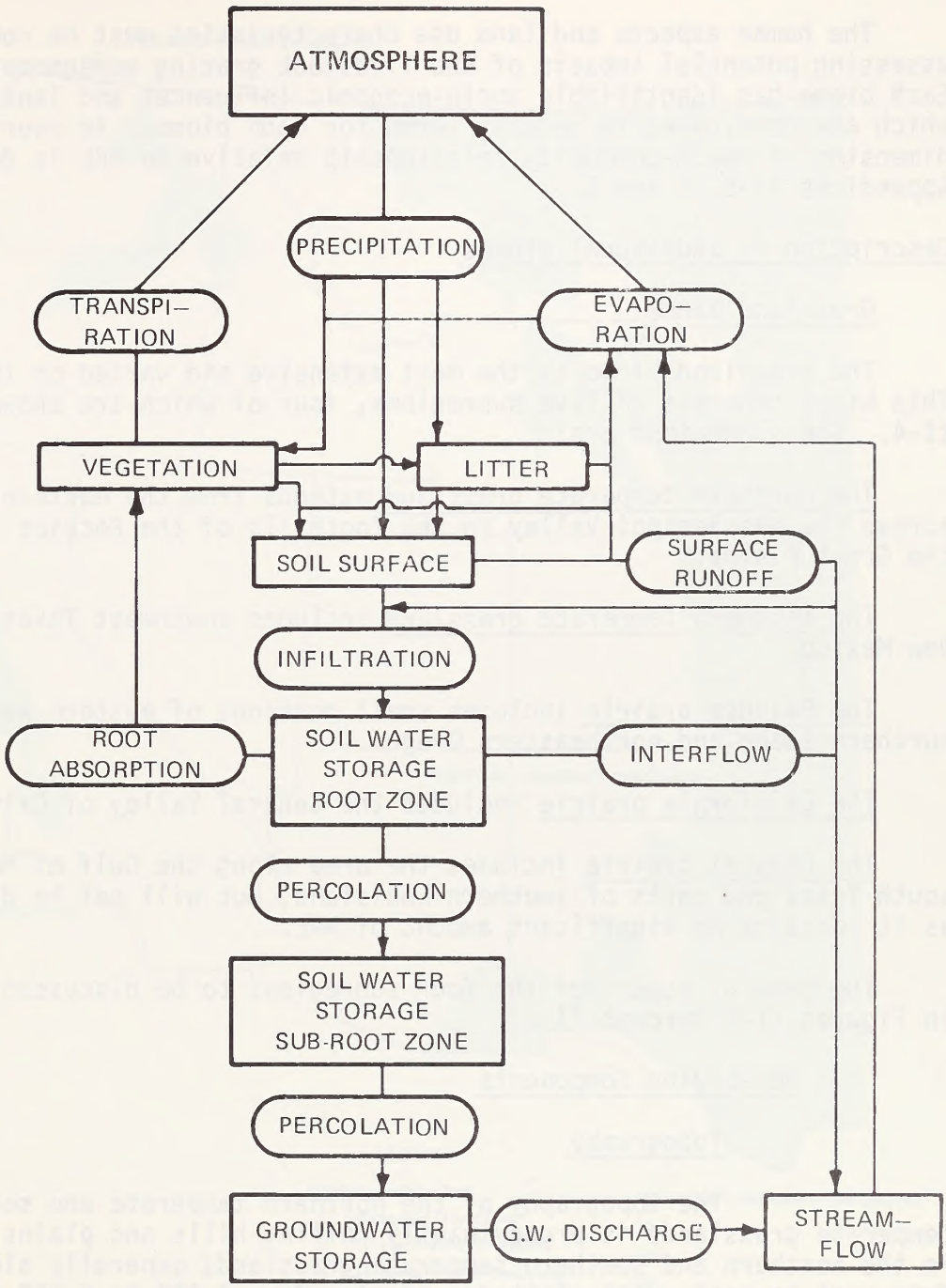


FIGURE II-3 FLOW DIAGRAM OF THE GRASSLAND HYDROLOGIC CYCLE

SOURCE: Striffler, W.D. 1969. "The Grassland Hydrologic Cycle," P. 103, in R.L.Dix and R.G. Beidleman (ed.), "The Grassland Ecosystem : A Preliminary Synthesis." Range Science Department Science Series No. 2, Colorado State University, Fort Collins, Colorado.

Social Interrelationships

The human aspects and land use characteristics must be considered in assessing potential impacts of the livestock grazing management program. Each biome has identifiable socio-economic influences and land use patterns which are considered in general terms for each biome. An overall social dimension of ranch-community relationship relative to NRL is developed in Appendices II-E, F and G.

Description of Individual Biomes

Grassland Biome

The grassland biome is the most extensive and varied of the biomes. This biome consists of five subregions, four of which are shown on Figure II-4. The subregions are:

The northern temperate grassland extends from the eastern forest across the Mississippi Valley to the foothills of the Rockies and includes the Great Plains.

The southern temperate grassland includes southwest Texas and southern New Mexico.

The Palouse prairie includes small portions of eastern Washington, northern Idaho and northeastern Oregon.

The California prairie includes the Central Valley of California.

The Coastal prairie includes the area along the Gulf of Mexico in south Texas and parts of southern Louisiana, but will not be discussed, as it contains no significant amount of NRL.

The general aspect of the four subregions to be discussed is shown in Figures II-5 through II-8.

Non-Living Components

Topography

The topography of the northern temperate and southern temperate grasslands is predominantly rolling hills and plains. The land in the northern and southern temperate grasslands generally slopes gently from west to east, with altitudes ranging from 4,000 to 5,000 feet along the western boundary and 400 to 500 feet along the eastern boundary. There are several isolated mountain groups in the western edge of the region--the Black Hills in South Dakota and the Bearpaw, Little Rocky and Big Snowy Mountains in central Montana. Other significant topographic features include the Sand Hill Region in central Nebraska, western Oklahoma and southwestern New Mexico; the Badlands of west-central South Dakota; and the glaciated regions of northern Montana and North Dakota.

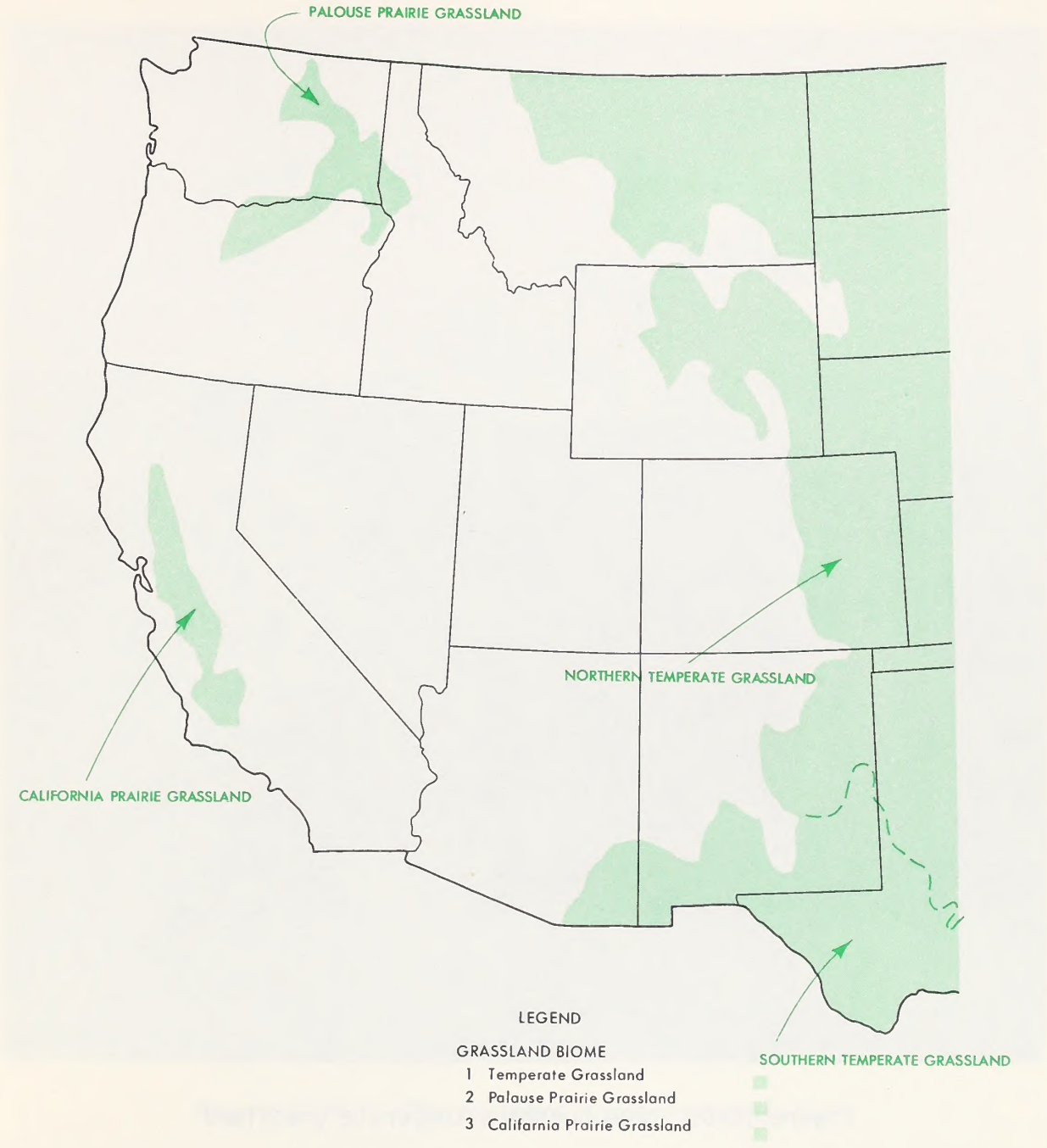


FIGURE II-4 THE GRASSLAND BIOMES IN THE WESTERN UNITED STATES.



Figure II-5. The northern temperate grassland



Figure II-6. The southern temperate grassland



Figure II-7. The Palouse prairie



Figure II-8. The California prairie

Most of the northern and southern temperate grassland drainage flows directly to the east, controlled for the most part by the original surface of the east-dipping sediments. Three principal plains levels and at least one remnant upland level dominate the landscape between the eastern and western boundaries of the grasslands. These form a set of steps ascending to the west.

The Palouse prairie includes small portions of eastern Washington, northern Idaho and northeastern Oregon. Topography varies from open hills and mountains to irregular plains and moderate to high-relief tablelands.

Soils[4/]

The soils of the northern and southern temperate grasslands vary considerably from north to south and from west to east. Only the soils in the western portion of the grasslands are described below.

Along the Canadian border in Montana and North Dakota, the soils are the cool-moist, organic-rich Mollisols. In southern Montana, southwestern North Dakota and northwestern South Dakota, soils are the warm-dry Entisols. In northeastern Wyoming, the mature warm-dry Aridisols predominate; in southwestern Wyoming and northeastern Colorado, the warm-dry organic-rich Mollisols are dominant. Southeastern Colorado has the warm-dry, immature Entisols or soils that are still forming and the warm-dry, mature Aridisols that are well-formed with natural horizons. Eastern New Mexico has four warm-dry soils: the immature Entisols, the organic-rich Mollisols, the brown-to-grey base Alfisols and the mature Aridisols.

The soils of the California prairie above the stream valleys are warm-dry Alfisols while those along the rivers and streams are warm-dry Entisols.

Palouse prairie soils are predominantly warm-dry Mollisols. At the junction of the Columbia and Snake Rivers, the soils are Entisols; farther up the Columbia, a small area of Aridisols has developed.

Minerals

A large portion of the oil and gas production of the United States is derived from this biome. Oil and gas exploration is very active with most of this activity confined presently to areas east of the Rocky Mountains. Commonly connected with the mineral activities are roads, pipelines, drilling sites and small surface plants.

Large, shallow deposits of coal occur in Montana, North Dakota and Wyoming. Strip mines are currently operating in the following counties under Federal coal leases:

4/ Soil stability classes, the soil orders and series and major soil characteristics are described in Appendix II-B, C and D.

State	County	Mines
Montana	Big Horn	1
"	Musselshell	1
"	Richland	1
"	Rosebud	2
Wyoming	Campbell	2
"	Carbon	3
"	Converse	2
"	Fremont	1
"	Hot Springs	1
"	Lincoln	1
North Dakota	Bowman	1
"	Burke	1
"	Mercer	3
"	Oliver	3
"	Ward	1

A typical strip mining operation results in the disturbance of several hundred acres of land. However, current operators are required by law and regulation to smooth and revegetate disturbed areas. This coal is used variously for production of electric power, the manufacture of coke and for other industrial purposes. At least half the coal currently being produced is shipped to distant points. The coal in this region is now in demand because its sulfur content is relatively low, enabling users to stay within present air pollution standards.

Water (37)

The major surface waters in the grassland biome are the through-flowing rivers and streams of major drainage basins--the Missouri, western Upper Mississippi, middle Arkansas, White, Red, lower Rio Grande, Texas-Gulf, middle Columbia-North Pacific and the California Central Valley. The large rivers, the Missouri, Yellowstone, Platte, Arkansas, Rio Grande, Columbia and Sacramento, receive most of their inflow from the higher elevations above the grasslands. Many of the smaller streams within the more arid grasslands flow intermittently.

Annual runoff in the grassland biome ranges from less than 1 inch to more than 5 inches of water in much of the northern temperate grassland.

The total dissolved solids in surface water in the grasslands range from less than 100 parts per million (ppm) to more than 1,800 ppm. The amount of dissolved solids in a watercourse are affected by the type of soil and parent material in the region, the length of time the water has been in the watercourse and the extent to which the flows are diluted by water from other sources. The specific chemical composition is an important consideration in determining whether water can be used for specific purposes. The total amount of dissolved solids in the water generally is the controlling factor in determining if a water supply is chemically suitable for most general uses.

The average suspended-sediment concentrations in streams in the grassland biome range from less than 230 ppm to more than 30,000 ppm. The suspended-sediment in a stream comprises such particulates as sand and silt. Suspended-sediment tends to be greater in areas where soil is not held in place by a dense vegetative cover.

The quality of water in most rivers, streams, lakes and springs in the biome is adequate for most plant, animal and human uses; however, localized pollution of water does occur.

Climate (3, 37, 38, 39, 40)

The northern temperate grassland has a continental climate. The average annual precipitation varies from 15 inches in the northwestern section to 30 inches in the southeastern portion. Seasonal precipitation varies from year to year. As shown in Figure II-9, most precipitation occurs as rainfall from summer thunderstorms. Temperatures range from 40 degrees F below zero to 110 degrees F above. Mean daily temperatures vary from 0 degrees F in January to 70 degrees F in July in the northern section, and from 50 degrees F in January to 80 degrees F in July in the southern portion (Figure II-10). Winds are generally from the northwest in the winter months; they average 10 mph, but range up to 40 mph or more and bring dry, cold air (Figure II-11). In the summer months, dense fog occurs about 5 to 10 days each year (Figure II-12). Humidity generally is low in the western portion and increases to the east.

The southern temperate grassland's climate is influenced by the continental air mass to the north and the humid Gulf to the southeast. The average annual precipitation varies from 10 inches in the northwest to 40 inches in the southeast portion of the biome. Figure II-9 shows that most precipitation occurs during the summer months. Temperatures range from 10 degrees F below zero to 110 degrees F above; mean daily temperatures vary from 35 degrees F in January to 75 degrees F in July in the southeast. Winds generally are variable and light in the winter months; during the summer, they tend to blow from the southeast (Figure II-11), bringing moist warm air from the Gulf.

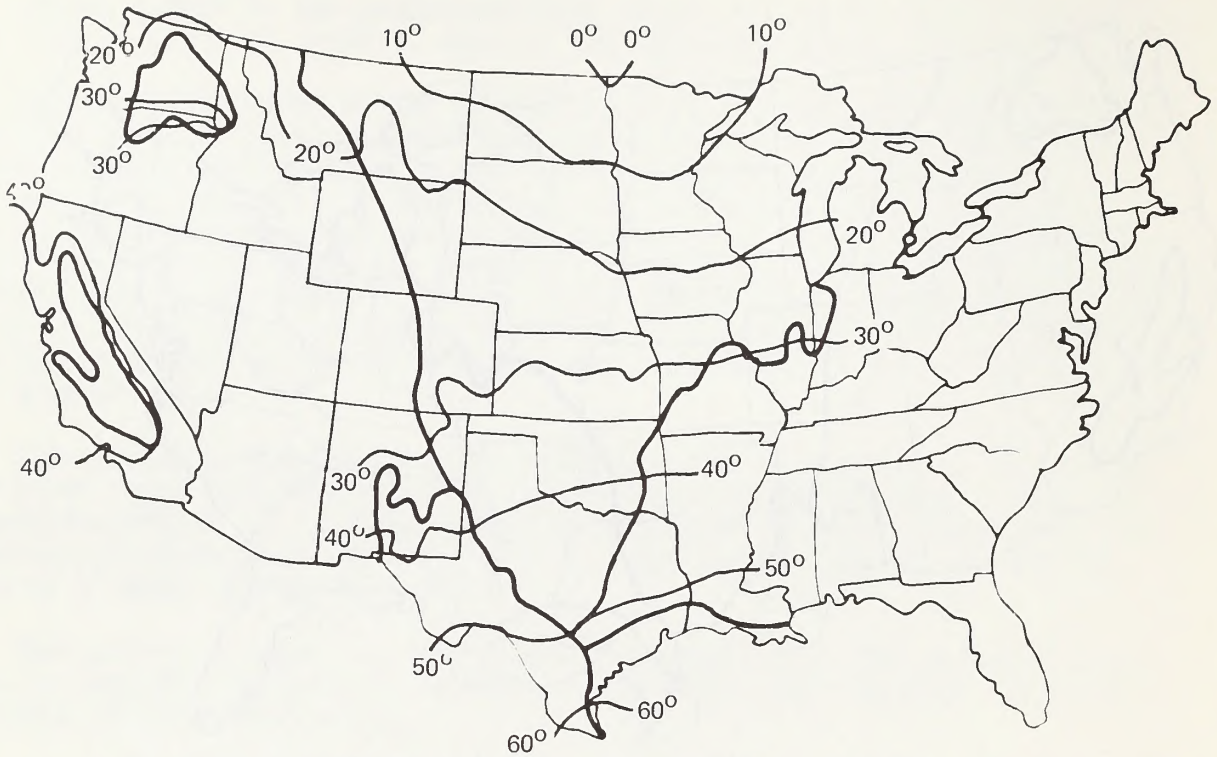


MONTHLY PRECIPITATION (INCHES)–JANUARY



MONTHLY PRECIPITATION (INCHES)–JULY

Figure II-9. Average January and July precipitation in the grassland biome



AVERAGE DAILY TEMPERATURES (°F)—JANUARY



AVERAGE DAILY TEMPERATURES (°F)—JULY

Figure II-10. Average daily temperatures in the grassland biome in January and July

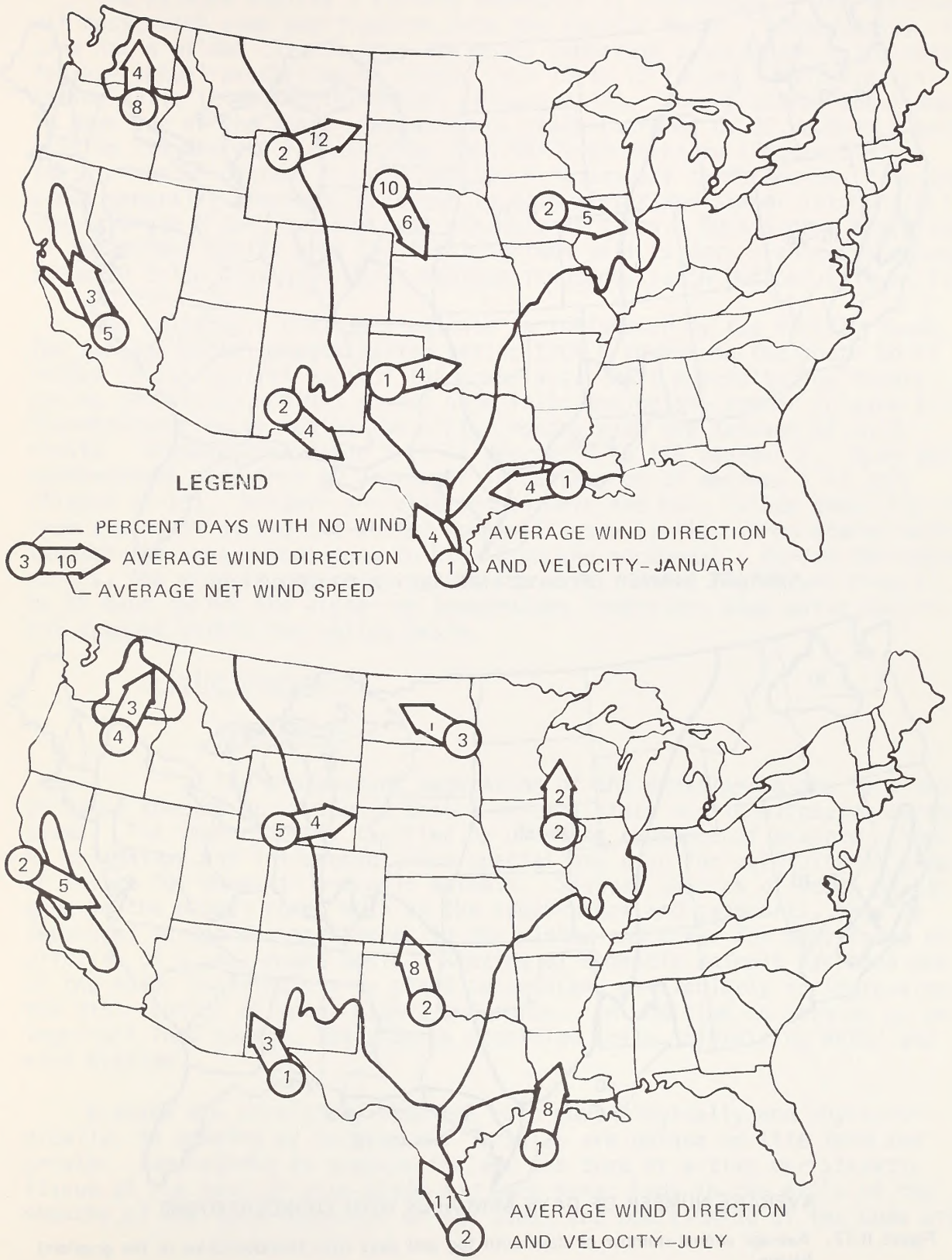
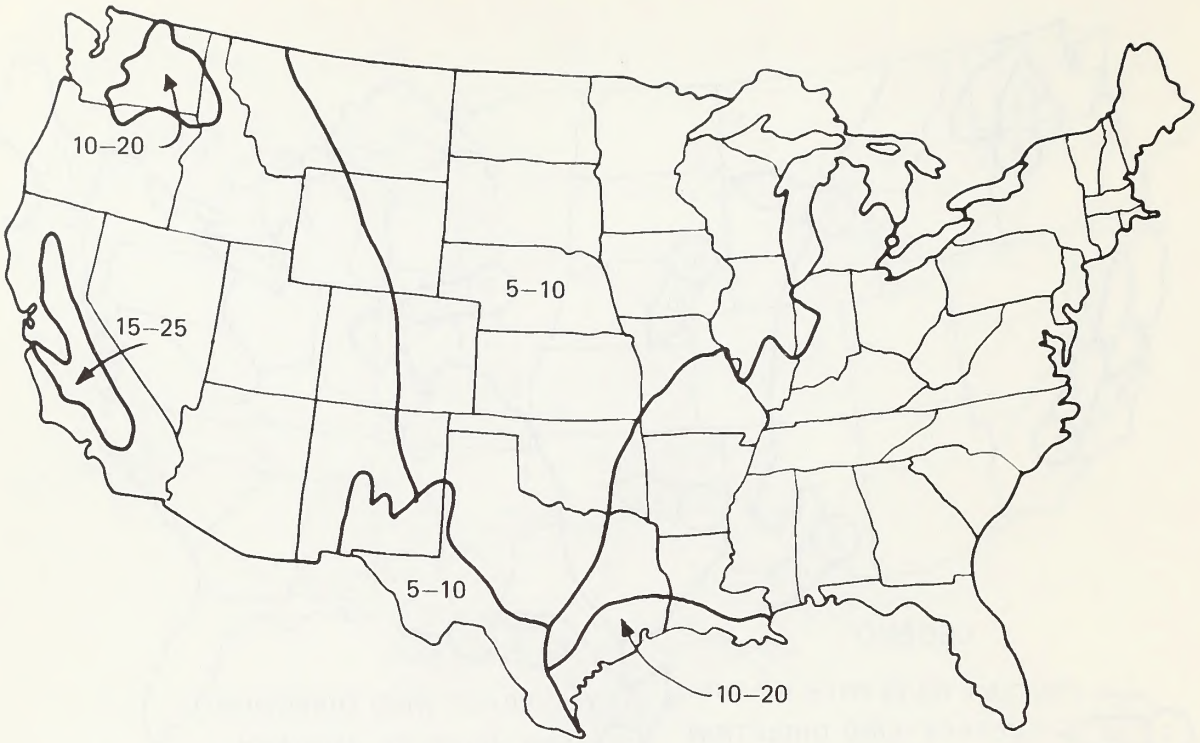
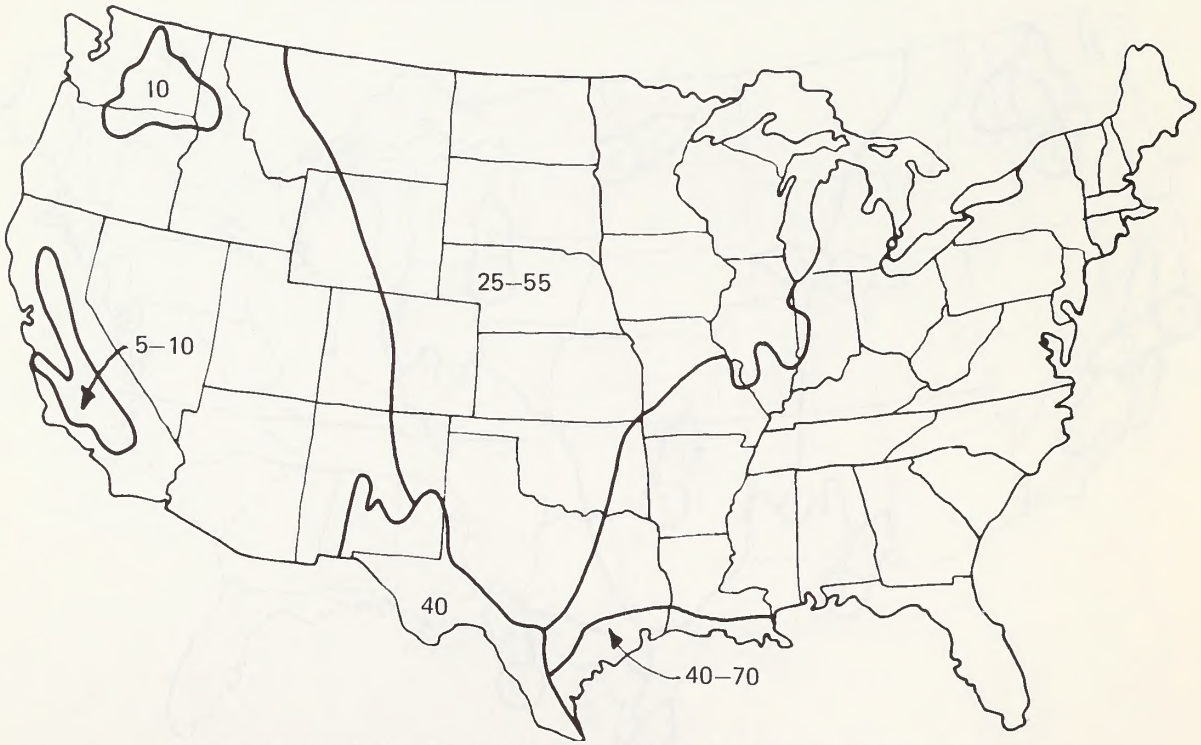


Figure II-11. Average wind direction and velocity in the grassland biome in January and July



AVERAGE NUMBER OF DAYS ANNUALLY WITH DENSE FOG



AVERAGE NUMBER OF DAYS ANNUALLY WITH THUNDERSTORMS

Figure II-12. Average annual number of days with fog and days with thunderstorms in the grassland biome.

The Palouse prairie's climate generally is influenced by the continental air mass, with some modification from the Pacific Ocean. Consequently, the area has a milder climate than the north temperate grasslands to the east. Average annual precipitation ranges from 10 to 15 inches. Most precipitation falls in the winter months (Figure II-9). Thunderstorms occur about 10 days out of the year. Temperatures reach extremes of 30 degrees F below zero to 110 degrees F above; the mean daily temperature (Figure II-10) varies from 25 degrees F to 30 degrees F in January to 70 degrees F in July. Winds generally are from the south in both winter and summer (Figure II-11). They average 8 mph, but may gust strongly at times. Dust storms may occur in the summer months when the light surface soil is dry. Dense fog occurs about 10 to 20 days each year; maximum frequency is in October (Figure II-12).

The California prairie's climate is influenced by the Pacific Ocean. The average annual precipitation varies from 6 inches in the south to 23 inches in the central part of the grassland. Most precipitation occurs during the winter months; almost none falls during the summer (Figure II-9). Thunderstorms occur during the winter months with the passage of cold fronts. Temperatures range from 15 degrees F to 115 degrees F. Mean daily temperatures vary from 40 degrees F in January to 80 degrees F in July (Figure II-10). Winters are mild and summers are hot. Winds generally are from the south during the winter months (Figure II-11). When storms move through the area, winds tend to blow from the northwest. During the summer months, the wind is generally out of the west. Dense fog occurs from 10 to 25 days during the winter as temperature inversions keep moist Pacific air trapped within the valley basin.

Living Components

Vegetation

The predominant vegetation of the grassland biome is a variety of grass species occurring in both a natural state and in extensive cultivated areas. The vegetation is typified by unbroken expanses of prairie. Many of the native and introduced grass species are used for agricultural crops or forage for domestic and wild animals. Several species of woody plants grow in the biome; some, such as the sagebrushes and sageworts, provide important forage for herbivores in the winter and cover for many forms of wildlife on a year-round basis. Grazing of domestic animals has been one of the major contributors to plant succession, particularly in increasing the distribution of woody plants and forbs. In addition to serving as an important food source, the grasses stabilize soils, minimizing water and wind erosion.

Grasses are remarkably adapted, both morphologically and physiologically, to grazing by herbivores. Grasses are unique in life form and growth. Adaptations to grazing include the zone of active meristematic tissue at the base of each blade and each node; buds in the axils of the sheaths of the lower portions of the stem; and positioning of the buds with

respect to grazing and fire. Having evolved under grazing and being thus adapted to use by grazing animals, grasslands actually remain in better condition if grazed than if left ungrazed.

In general, the grasslands are located where rainfall is insufficient to support forest-like vegetation, but is sufficient to preclude the formation of a desert.

Marshes, lakes, ponds and streams support various forms of aquatic vegetation. Algae are the most important producers in the fresh-water environment. Except for pond and duck weeds, most higher aquatic plants are members of diverse families in which the majority of species are emergent.

The northern temperate grassland includes three broad perennial grass zones extending north and south across the western Mississippi Valley. The tall grass prairie is located on the eastern edge of the grasslands; the mixed grass prairie is intermediate; and the short grass prairie extends along the western edge.

The southern temperate grassland most resembles the short grass zone of the northern temperate grassland. It is the driest area in the grassland biome. Parts of it are dotted with desert shrubs because of the dry climate and overgrazing.

The Palouse prairie consists of mid-grass species. In some areas, bunch grasses have been replaced by sagebrush. Large wheat crops are produced in portions of the region.

The California prairie originally consisted of mid-grasses of the bunch grass type similar in form to those of the Palouse. Many of the native grass stands have been replaced by annual grasses introduced from Europe. Parts of the tule marshes along the major drainages have been converted to rice production.

Animals

The high annual turnover of net primary production in most grassland communities provides a foodbase for a large number and variety of animals. Many species are grazers, others are burrowers and a large number of birds are ground nesters. Large herbivores, such as deer and antelope, are a characteristic and sometimes common feature. Insect life is abundant, varied and heavily utilized as food by many secondary consumers. Every major animal phylum and many taxonomic groups of the plant kingdom are represented in the biome. Many of the animals are gregarious and frequently occur in large concentrations.

Droughts periodically occur in grassland communities, and the populations of some wild animal species can fluctuate widely from year to year.

Large domestic herbivores, such as horses, cattle, sheep and goats, have largely replaced, or live in competition with, the native herbivores. Some of the joint use of rangeland ecosystems by domestic and native herbivores is compatible. Grazing significantly influences grassland ecosystems throughout the United States.

Terrestrial Wildlife (41)

The most conspicuous terrestrial wildlife are mammals and birds. In the northern temperate grassland, characteristic animals include antelope, mule and white-tailed deer, white-tailed jack rabbits in the north and black-tailed jack rabbits in the south, prairie dogs, ground squirrels, coyotes, badgers, ferrets, pocket gophers; various waterfowl, prairie chickens, sage grouse, Swainson's hawks, rough-legged and ferruginous hawks, burrowing owls, ground-nesting birds such as the meadowlark and horned lark; bullsnakes, rattlesnakes and an abundance of insects.

The southern temperate grassland includes many of the same animals found in the north, although some are a different species or subspecies. Other forms more common in the south include the antelope jack rabbit, desert cottontail, collared peccary, scaled quail, white-winged dove, scissor-tailed flycatcher, mocking bird, kingsnake and several kinds of lizards.

In the Palouse prairie, the sharptail grouse was abundant in the past. The short-eared owl, burrowing owl and marsh hawk nest in the grassland. The cottontail and pygmy rabbit, pocket gopher, golden-mantled ground squirrel and various grasshoppers are characteristic fauna.

In the California prairie, the California ground squirrel is one of the most characteristic species. The area is important wintering habitat for waterfowl. Many of the same animals, perhaps of different subspecies, occur here as in other grassland areas.

Many grassland species warrant special consideration because of their particular needs. For example, a local population may require a specific site at a particular season to continue its life cycle, such as strutting grounds and adjacent nesting habitat for sharptail grouse, sage grouse or prairie chickens; and waterfowl and shorebird nesting areas around potholes, reservoirs and marshes.[5/]

Some species extend their distribution into vegetal subtypes, and the local animal populations become totally dependent upon the restricted habitat. Some species, while not endangered throughout their range, have remnant populations in danger of being eliminated in local areas. The

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5/ The water bodies in the northern temperate grasslands of the United States and Canada produce most of the waterfowl in North America.

sharptail grouse in the Palouse prairie is an example. Local populations of some species are restricted to relatively small sites, such as prairie dog towns. Other species, such as the endangered black-footed ferret, are dependent upon the prairie dog as a primary food source and utilize the prairie dog burrows for homes.

Aquatic Wildlife (41)

Aquatic wildlife includes fish and various invertebrates confined to a water environment such as shellfish. Aquatic fauna in the grassland area are less diversified than in the more humid regions. The natural distribution of nonmigratory fish is confined to water bodies with accessible and suitable spawning areas.

Anadromous fish species (examples - salmon, steelhead) utilize the river systems which pass through the Palouse prairie and California prairie grasslands for spawning purposes.

Warm water fish species occur in larger streams and warm standing waters. Examples include the shovelnose and lake sturgeons, paddlefish and gars of the Missouri River. Channel catfish inhabit small tributaries of the Missouri and some large reservoirs with warm, muddy waters. Bullheads are adapted to a wide range of conditions, but prefer warm streams or ponds. The black bass, blue gill and perch occupy a wide range in relatively cool streams, lakes and reservoirs. Cold water species in the high elevation, clear, spring-fed streams include various trout, mountain whitefish, grayling, suckers and sculpins.

Threatened or Endangered Wildlife (42)

Several threatened or endangered species of wildlife are characteristic of the grassland biome. These include: San Joaquin kit fox, black-footed ferret, American peregrine falcon, Mexican duck, the bluntnosed leopard lizard and the masked bobwhite quail.

Threatened or endangered fish species are found within the biome. Currently identified species include the Pecos gambusia and greenback cutthroat trout.

Domestic Livestock (43)

During the period of early settlement by Europeans, the grasslands were used almost exclusively for livestock grazing. Today, beef, lamb and wool still are the principal products of areas that have not been converted to crop production.

More cattle than sheep and goats are grazed on the grasslands because cattle are better adapted to the type of forage produced in most of the biome. Goats are limited, for the most part, to the brushier areas of the

south temperate grassland. Sheep production is a significant land use in areas where shrub species are a prominent component of the vegetation.

Cattle numbers have steadily increased over the years, and sheep numbers have sharply declined. After a period of rapid decline, horse populations have remained fairly stable in recent years.

Wild Horses and Burros[6/]

Wild free-roaming horses and burros on national resource lands are protected by PL 92-195. BLM is responsible for the management and protection of these animals.

The population of wild horses and burros on NRL in the grassland biome is not significant when compared to the desert and woodland-bushland biomes. In Montana, there are an estimated 264 wild horses with around 150 head in the Pryor Mountain area, part of which has been designated as the Pryor Mountain Wild Horse Range. There are no known wild burros in Montana. A few wild horses and burros have been reported in the grassland biome of New Mexico.

Generally, it is recognized that burros and horses compete for both food and water with wildlife and domestic stock.

Soil Organisms

The function of soil fauna in grassland ecosystems is presented by Paris in a paper on the grassland ecosystem (44). The following information was taken from this paper:

Taxonomic Group	Food	Community Function
Earthworms	Litter, mineral soil	Primary decomposition, comminution of litter, mixing of soil and litter, producing crumb structure in soil.
Mollusks	Green and dead forbs, fungi	Primary decomposition herbivory.
Isopods	Litter	Comminution of litter, some herbivory.
Diplopods	Litter	Primary decomposition, comminution of litter.

6/ Environmental Impact Statement - Proposed Wild Free-Roaming Horse and Burro Management Regulations. U. S. Department of the Interior, Bureau of Land Management, Washington D. C. 1973.

Taxonomic Group	Food	Community Function
Dipterans	Litter, carrion	Comminution of litter, primary decomposition of carrion.
Coleopterans	Dung, carrion	Primary decomposition of dung and carrion.
Nematodes	Protoplasm of fungi, bacteria, roots and small animals	High rate of energy dissipation, nitrogen turnover, influence on microbial populations uncertain.
Enchytraeids	Fungi, bacteria	Not well known, but important in energy flow and probably nutrient cycling.
Collembolans	Fungi, bacteria, algae, fluids of plants and small animals	Comminution of plant remains, dispersal of fungal spores, effects on microbial populations uncertain.
Mites	Fungi, bacteria, algae, small animals	Dispersal of fungal spores, influence on fungal populations uncertain, communition of litter.
Ants	Omnivorous	Probably important in energy flow, may influence aphid populations by predation, seed consumption, mounds and tunnels affect soil structure.

Paris concludes that decomposing reducers are essential for maintaining an equilibrium state in the energy flow and nutrient cycle of grassland ecosystems. Even in the shortgrass prairies of North America where several of these groups are absent or rare, soil insects (dung beetles, fly larvae and ants) are probably important in ecosystem dynamics. Were these organisms to disappear from a grassland, not only would their direct contribution to energy flow and nutrient cycling be eliminated, but the rate of microbial decomposition would decrease.

The soil microorganisms are an important part of the grassland ecosystem. It has been estimated that for a bluegrass community, decomposers use 70 percent of the net production (45). Another study estimated that for the total energy trapped by photosynthesis, less than 14 percent was respired by higher plants, 28 percent was consumed by herbivores and 56 percent was released during the decomposition of plant materials (46). Additional data on the role of soil organisms may be found in a paper by Clark in the IBP grassland publication (47).

Human

Demographic characteristics of the grassland biome vary considerably from one area to another. Most lands in the biome are rural. However, the biome also includes several large urban centers with significant differences in population densities, economies and social environments. Nearly 17 percent of the total western states' population lives in this biome.

Most of the counties in the biome are sparsely populated; densities over much of the area in 1970 were less than 10 persons per square mile, compared with a national average of 57.3 persons per square mile and a western state average of 29 persons per square mile. Most of the areas having a low population during 1960-1970 lost people in the decade. Significant gains were experienced in most urban areas (48). The biome as a whole lost rural population at a greater rate than the 5 percent western states' average.

Income levels throughout the biome are generally lower than average for the West. For example, per capita income in the plains of New Mexico is only about 70 percent of the western states' average while the per capita income of the Colorado and Wyoming Plains is about 90 percent of the average. The percentage of families under the poverty level is also generally greater (except in Wyoming) than the western average.

Low population densities and other characteristics of the rural areas reflect economies geared to resource production and primary processing. Agriculture and agricultural processing are principal economic activities. The isolation of resources from major markets has limited industrial growth in much of the area. The recreation-tourism industry has grown rapidly over the past 20 years and provided employment in the services sector of the economy.

Employment in agriculture is 4 percent of the work force for the 11 Western States as a whole. In the grassland biome, the percentages range from 4 percent in Colorado to 26 percent in northeastern Montana. However, livestock production makes up varying proportions of the agricultural sector. The percent of total income derived from livestock production is estimated to range from slightly over 2 percent in the Central Valley of California to nearly 12 percent in the Great Plains of Montana. Except for the California and perhaps Colorado portions of this biome, livestock production contributes relatively more to total incomes than in any other biome. The NRL supply 2,890,000 cattle AUM's and 500,000 sheep AUM's to the livestock industries of the biome. These AUM's account for 8 percent of the total cattle and sheep feed consumed in the biome except for the sourthern grassland area of New Mexico, where it approaches 19 percent.

Small towns and villages are scattered throughout the rural areas of the biome. Towns with populations of 5 to 10 thousand are market centers and generally are located along major transportation routes. (See Appendix II-E for rural-urban trends.)

Urbanized areas located in the western portion of the biome in close proximity to extensive Federal lands include Great Falls and Billings, Montana; Boulder, Denver, Colorado Springs and Pueblo, Colorado; Spokane, Washington; and the extensive Central Valley metropolitan complex in California. Metropolitan populations of each of the areas exceed 50,000. The Denver metropolitan area, for example, had a 1970 population of 1.25 million and a growth of 32 percent from 1960 to 1970 (48). If present trends continue, the prediction of an urban megalopolis stretching from Cheyenne, Wyoming, to Pueblo, Colorado, may be realized by the end of the century.

The metropolitan areas have combinations of capital, labor, services and demand for products that support industrial development. The population concentrations support educational and cultural opportunities and a variety of housing and personal services. Economic and social environments are markedly different from those of rural areas in the biome.

Ecological Interrelationships

The grassland ecosystem is probably the most studied of all ecosystems, and there is extensive literature available on many of the ecological components. However, the aquatic ecosystem and its relationship to the terrestrial community is less well known than the ecological relationships within the terrestrial community.

The grasslands generally occur in regions of limited moisture; droughts are common. Precipitation during the May-to-October growing season occurs largely as convectional thunderstorms or frontal storms. The output of the hydrologic system is low compared to other biomes. Variations among the communities within the biome (such as short-grass and mixed-grass communities) generally occur because of varying rainfall, insufficient soil storage capacity or both. Winds and the high evapotranspiration rates also have an important effect on components of the ecosystem. Thus, water is a critical factor in the grassland ecosystem.

The grassland is a vast solar-powered ecosystem capable of producing great quantities of energy. Annual production is generally high and the turnover of the biomass occurs rapidly on an annual basis. Only small amounts of nutrients are tied up in the biomass. Soil organisms are numerous. As much as half of the producer biomass is directly decomposed by fungi and bacteria rather than by herbivores.

Nitrogen and phosphorus are the most important nutrients provided by vegetation to support other life forms in the grassland biome. Unconsumed nutrients are recycled through the soil in a short time because of annual mortality or dieback of the grass. Consumed nutrients deposited as dung and urine may cycle even faster. This contrasts with biomes such as the forest biome where the nutrient cycle is slower and where a large share of the nutrients are stored in trees having a natural life span of hundreds of years. However, the nitrogen fixation rate on predominantly grass-covered

sites is very slow and could be a critical factor in determining the revegetation recovery period of some disturbed areas.

Except in locations of steep topography, low precipitation and unstable soil, the grassland ecosystem generally is stable. Surface disturbance can be rehabilitated and natural successional development occurs rapidly. Even though it may take many years to restore the original vegetation and animal species of the ecosystem, lesser species invade rapidly into a disturbed area.

The grasslands are most vulnerable to damage early in the growing season and in periods of drought, which commonly occur.

Land Uses

The Homestead Act of 1862, railroad construction, irrigation and other factors lead to the cultivation of vast areas in the grassland biome. Most lands remaining in a natural condition are unsuited for cultivation. Some are privately owned, but many in the western grasslands are federally owned. The uncultivated lands are extensively used for livestock grazing and outdoor recreation. Hunting, fishing, hiking and other outdoor recreation activities are particularly significant on lands remaining in Federal ownership.

In the northern and southern temperate grasslands, the amount of agriculture and the percentage of private ownership decrease progressively from east to west. Cattle ranching and wheat farming predominate in the western section. A large portion remains undeveloped, providing significant recreation opportunities. Roadless sections with primitive qualities remain in some areas.

The California prairie contains productive irrigated agricultural land. Nuts, fruits, vegetables, rice and specialty crops are grown in the area. Undeveloped areas are extensively used for livestock grazing and outdoor recreation. Outdoor recreation is a particularly significant use on some lands because of the proximity of large metropolitan areas.

Wheat grown by dry farming methods is the major agricultural use in the Palouse prairie. Significant areas in the western portion are irrigated; unirrigable portions remain undeveloped and are used for grazing.

Most metropolitan areas and some of the smaller cities in the biome are growing rapidly and using additional lands for residential, commercial and industrial expansion. Inevitably, increased population concentrations place additional demands on adjacent rural and undeveloped lands for recreational uses.

Mineral extraction industries account for some land use. Oil and gas operations, and the mining of coal and some other minerals are quite active in this biome.

Hazards

Many plant communities within the grassland biome contain plants poisonous to livestock. These plants may appear at various seasons during the year, or only at a specific season of the year. The entire plant may be poisonous or only a certain portion may be poisonous.

Many poisonous plants, when present in a healthy plant community, do not have an adverse effect on the herbivores. However, a disturbance of the healthy plant community by overgrazing may allow for an increase in the poison plant density so that a significant death loss of livestock may occur.

Other natural events--above normal moisture at precisely the right time, or freezing temperatures--can also cause a healthy plant community to become poisonous to some or all of the consumers of that community.

Some plants may be excellent forage when growing in certain locations. However, the same species will accumulate toxic amounts of elements such as selenium when grown in soil containing them. A good example of this is four-wing saltbrush.

Some locations within the biome have water that is extremely high in total soluble salts. Water that is high in soluble salt may be consumed by wild or domestic animals and, because of the amount of salt, the animal may not develop at its maximum capability. Other water may contain trace amounts of chemicals such as arsenic that can be lethal to both wild and domestic animals.

Aesthetics

The grassland may be described as primarily gently rolling hills and broad expanses of flatlands. In some areas near major streams, particularly in drier portions of the biome, continuity of the land may be interrupted by sharp breaks down to floodplains of the stream. Because of the relatively gentle slopes in the grasslands, few of man's activities interrupt continuity of the form. Where the form is disturbed, it is usually quite easily replaced to a natural or near-natural condition. Where the landscape is still in a natural state the soft texture of the grass-covered slopes is interrupted by occasional rock out-crops. In drier portions, ground cover may be in scattered patches with some exposed soil. Much of the eastern portion of the biome, along with the Palouse prairie and the California prairie, has been converted to agriculture. Here the texture changes from field to field as the crops change.

Although the texture of the grassland vegetation is easily disturbed, areas can recover rapidly if given the opportunity to do so.

Lines in natural portions of the biome play a minor role in the landscape and are evident only in ridgelines and in the occasional road or

powerline crossing through the area. In the agricultural areas, lines become much more obvious. Crop rows, field edges, fence lines and roads become a dominant element in the landscape.

Color is not a dominant factor in the grassland biome. It may play a more important role in moist agricultural areas, but in the natural and drier areas the colors are generally muted and tend toward a monotone.

Scale is difficult to define on the flat plane of the grasslands. Any vertical element that is introduced into the landscape has a tendency to define the scale, but also draws the eye and becomes a focal point.

The total effect of the landscape character of the grassland biome will vary with the individual observer. To one, openness may connote a freedom, room for movement, a challenge to action. Another may feel overwhelmed, lonesome and unprotected. To some, it may seem a monotonous wasteland. To the acute observer, subtle changes in tone or forms may be fascinating.

Sound and smell, although they may be an important factor in a very localized area, are impossible to describe for an entire biome.

Human Interest Values

Geological

Human interest in geological phenomena tends to center on the features that are different and strange or beautiful and exciting. Things like volcanic necks, caves with stalagmite formations, sinks, natural arches and bridges, fossils and erosional features arouse the interest and curiosity of the viewer. The grasslands biome has some of these features but, being primarily a flat landscape, they are rather limited.

The northern temperate grassland has colorful heavily eroded areas like the Badlands of the Dakotas, dome mountains like the Little Rockies, canyons such as in the Missouri Breaks, fossil beds and volcanic remains such as Devils Tower in northeast Wyoming.

The southern temperate grassland contains limestone caves in the Pecos River region and sinkholes near Roswell, New Mexico.

The California prairie contains dome mountains (Marysville Buttes) in the vicinity of Sacramento and geologic faults with visible displacement, like the San Andreas Fault along its eastern edge.

The Palouse prairie contains interesting geologic phenomena such as the scablands, the Grand Coulee and other evidence of past volcanism in the region.

Archeological

The biome contains archeological sites depicting the three broad developmental stages of American Indian prehistory. These are the Paleo-Indian, the Archaic and Agriculture stages.

Both the eastern Big-Game Hunting Tradition and the Western Old Cordilleran Tradition occur within the biome. The Big-Game Hunting Tradition is recognized in kill sites of such animals as the bison, mammoth, camel and horse. More rarely campsites are found with chipping and other camp debris. Some cave sites have been found. The Big-Game Hunting Tradition has been recognized in the northern and southern temperate grasslands.

The Old Cordilleran Tradition represents a relatively unspecialized hunting-gathering-fishing way of life. Evidence comes from old lakeshore campsites, caves and deeply stratified refuse dumps in favorite fishing spots. The tradition has been found in both the Palouse and California prairie grasslands.

The Archaic stage is found as a Plains Archaic Tradition in the northern and southern temperate grasslands. During this stage emphasis was placed on gathering of plants and some shellfish in addition to hunting.

In the Plains Archaic, this emphasis is indicated in the trash dumps, dry cave sites, burned rock debris mounds and campsites. Bison and other animal kill sites continue to be found, some being buffalo jumps with rock alignments.

The Eastern Archaic is found in the eastern portion of the northern temperate grassland. It is similar to the Plains Archaic, but with more emphasis on gathering--especially shellfish.

The Desert Archaic Tradition is found in the southern temperate grassland and had some input into the cultures found in the California prairie. The Desert Archaic subsistence pattern was based primarily on small seed gathering and small animal hunting. Archeological evidence comes mostly from campsites, dry caves, petroglyphs and pictographs.

The Agriculture stage is represented in the northern temperate grasslands by the Plains Culture (Woodland and Plains Village Traditions). Although reverting to a strong hunting culture once again after the introduction of the horse in the 1700's, the Plains Culture base originally was agriculture. Sites are predominantly surface and pithouse village sites (some stockaded), tipi rings and other rock alignments, pictographs and petroglyphs, caves, buffalo jumps and animal traps, log structures, vision quest sites, pole structures and burial mounds.

The eastern portion of the northern temperate grasslands also contains remains of the Agricultural stage, Northeastern Woodland Tradition people with their temple and burial mounds, large village sites and occasional cave sites.

Evidence of the Agricultural Pueblo Tradition can be seen in the northern portion of the southern temperate grassland. Evidence of the Pueblo Tradition, here represented by the Mogollon Division, includes sites of masonry buildings, pithouse dwellings, occasional irrigation systems, trash mounds associated with villages, pictographs and petrglyphs, caves, fortified sites and roasting pits.

In the Palouse prairie, agriculture was never developed by the native inhabitants so that the final precontact periods are represented here by the Northwest Riverine Tradition. These people lived along the river valleys and their archeological sites are mostly the remains of pithouses and above-ground houses in villages along the rivers, campsites, quarries, petroglyphs and burial grounds.

Similarly in the California prairie, the Agriculture stage never developed and the Archaic stage continued up to the time of contact with non-Indians. Large shell middens occur near water, quarries and village sites.

Historical

Historically, this region has seen early explorations and ownership by the Spanish, French, English and Americans. During the fur-trading period, much activity took place and many trading posts were established. Army posts and camps constructed during the Indian Wars were, in part, concurrent with the fur trade. Immigration, railroads, gold seekers and finally settlement by farmers and ranchers marked the conquest of the plains. These activities are marked by the remains and sites of old forts, trading posts, battlesites, cattle trails, railroads, mining ghost towns, homestead failures, and more recent ventures in oil, gas and coal extraction and water reclamation.

The northern temperate grasslands were considered, because of their dryness and the Indians, as a barrier to movements to the more fertile areas of the West. Consequently, much of the history here involves Indians, soldiers and immigrants passing through.

The southern temperate grasslands were explored in the 16th century by the Spanish, but little settlement took place. No real inroads into settling the various parts of the biome occurred until about 1850 with the advent of gold discoveries in California and the Rocky Mountain west.

The California prairie received some settlement in the Mexican Period, but its agricultural greatness began as a supplier of foodstuffs for the 49'ers. The Palouse prairie too was settled as an agricultural area in the mid-1800's.

Cultural

Most prominent of the minority groups occupying the grass-land biome are American Indian groups still living on the various

reservations and using, to some extent, their lands for religious and cultural activities. In the southwestern portion of the biome are Spanish-American communities whose life-style is still dependent on traditional land uses outside their villages.

Many of the native cultures attach religious or mythological significance to specific sites. Disturbance or intrusion upon these sites by others may seriously affect their religious values. Many other ethnic and religious groups have needs such as appreciation of their value systems and recognition of their desires to be left alone.

Desert Biome

The desert biome in the United States occupies an extensive area between the coniferous forest in the Rocky, Cascade and Sierra Nevada Mountains. It is found at elevations below the woodland-bushland types and in other areas where precipitation is too low to support grassland or woodland vegetation. It includes two subtypes--cold deserts and hot deserts. The former have warm summers and cold winters; the latter have moderately warm winters and extemely hot summers. The locations of the two types of desert are mapped in Figure II-13.

The cold desert extends through central Washington, eastern Oregon, southern Idaho, southwestern Wyoming, northeastern California, most of Nevada, Utah, northern Arizona, northwestern New Mexico and extreme western Colorado. It includes islands and fingers of grassland and woodland types (49). Parts of it are referred to as the High Desert, Great Basin Desert or Painted Desert.

The hot desert extends through southeastern California, southern Nevada, southwestern Utah and southern Arizona. Parts of it are referred to as the Mojave Desert, Lower Colorado River Desert or Sonoran Desert. The Federal Government owns much of the land in this biome.

Typical landscapes in the cold and hot deserts are shown in Figures II-14 and II-15.

Non-Living Components

Topography

Much of the desert in Arizona, California, Nevada and western Utah is comprised of basins flanked by low to high mountain ranges. In southeast Oregon and southwest Idaho, the Columbia Plateau contains plains, medium to high hills and high-relief tablelands. The Colorado Plateau in eastern Utah, western Colorado, northern Arizona and northwest New Mexico is characterized by moderate to high-relief tablelands and deep canyons.



(*Generally included within the desert biome boundary.)

FIGURE II-13 DESERT BIOME

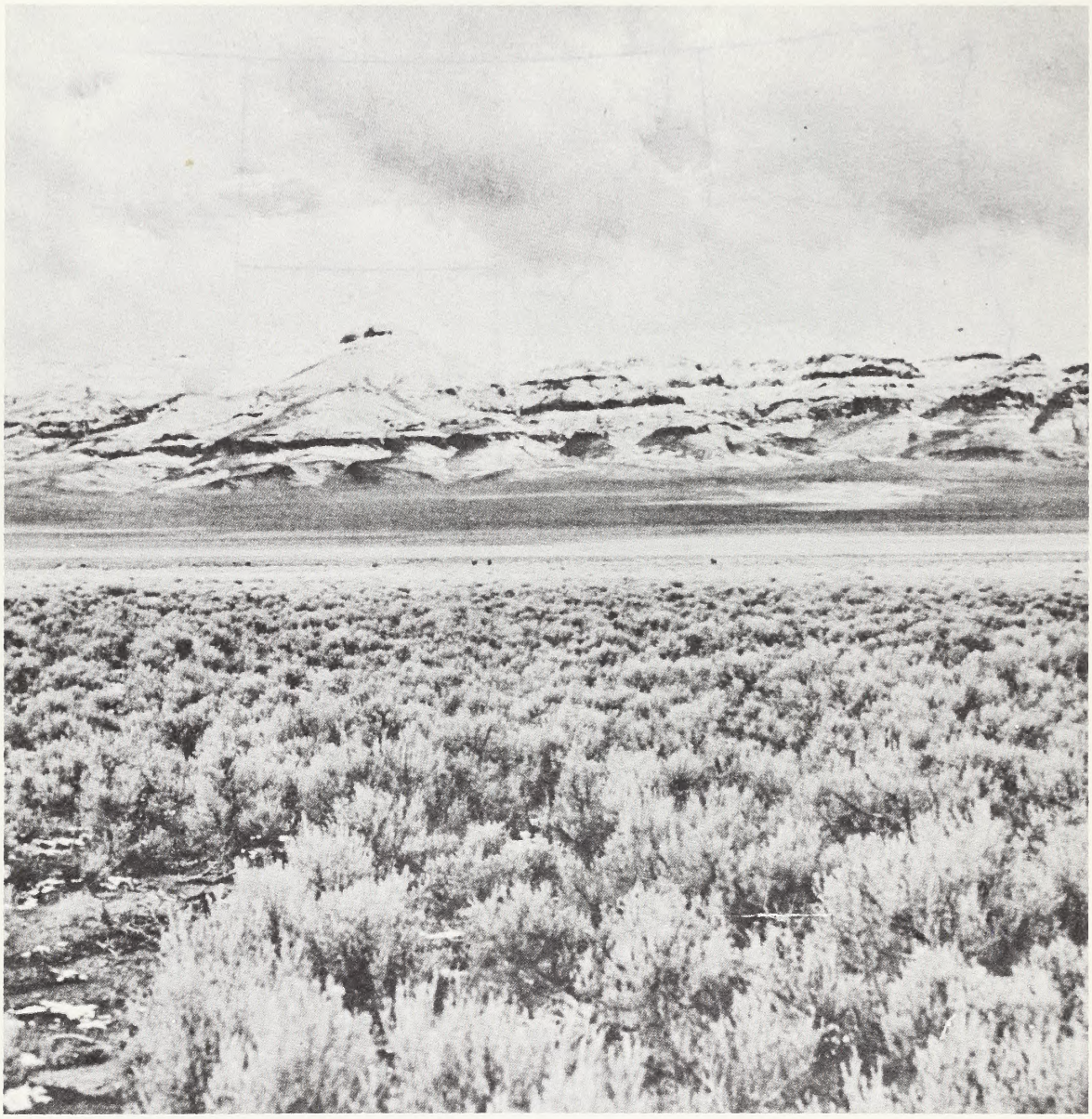


Figure II-14. The cold desert

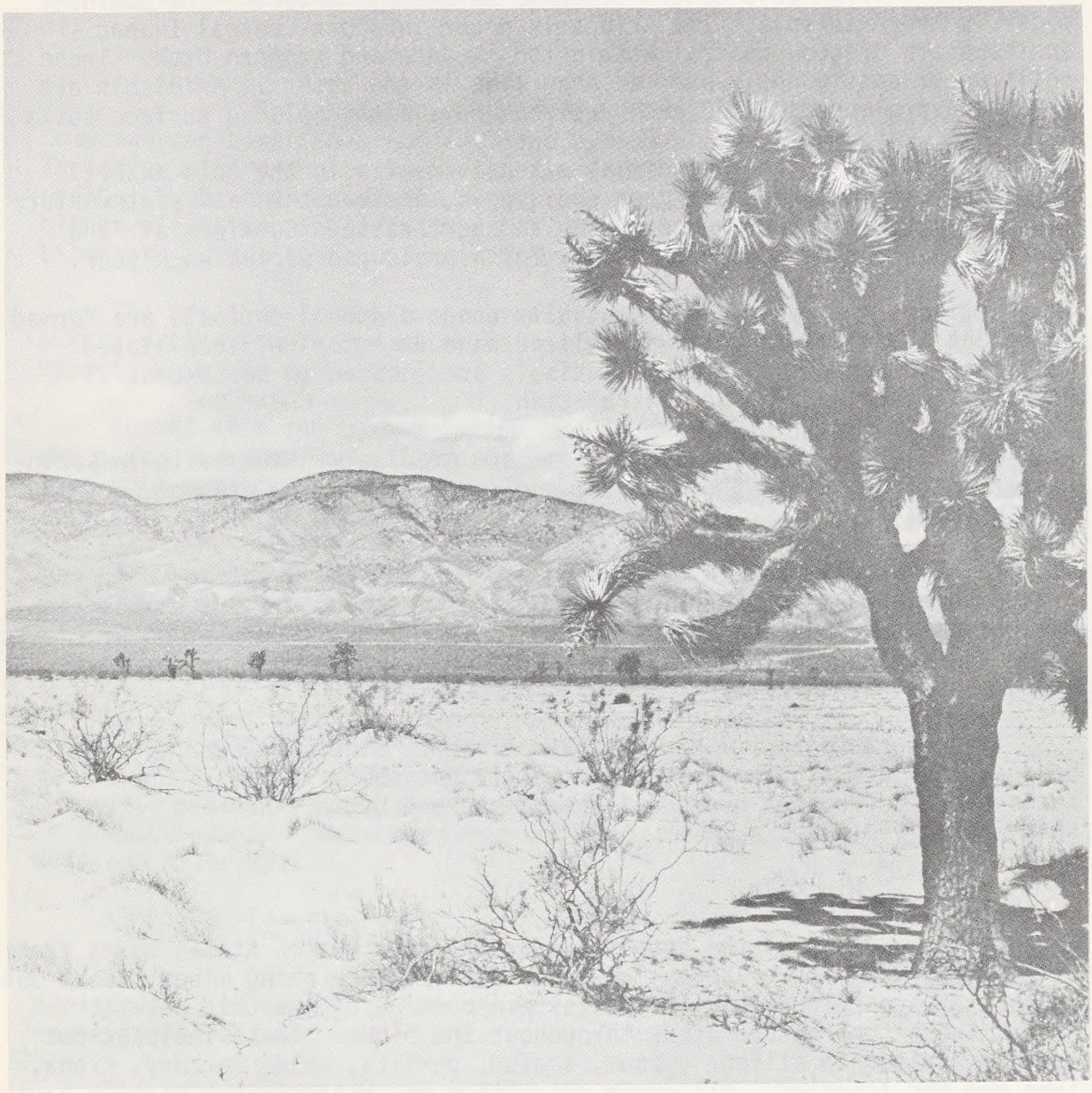


Figure II-15. The hot desert

Soils

The cold desert contains three soil orders. The dominant order is the Aridisols. The Aridisols occur in south-central Idaho, southeastern Oregon, central Washington, Nevada and western Utah. These soils occur contiguously over a large area in the desert. Aridisols are dry for a prolonged period each year and have light-colored surface soils.

Mollisols are the second most extensive soils in the cold desert. They occur in eastern Washington and Oregon, southeastern and southwestern Idaho, central and southwestern Utah and northeastern California. The Mollisols in the cold desert are dry for a prolonged period each year.

Entisols are young and essentially nondeveloped. Entisols are formed in recent alluvium, recently stabilized sand dunes or on steep slopes subjected to rapid soil creep. Entisols are located in south-central Oregon, western Nevada and central Utah.

The soils of the hot desert biome are Aridisols. The soils in southeastern California, southern Nevada and southern Arizona are hot, dry and low in fertility.

The Aridisols contain two suborders: Orgids and Orthids. Both suborders have a hardpan or duripan, but differ in structure and composition. The hardpan developed under the suborder Orgid is an accumulation of clays; under the suborder Orthid is found an accumulation of calcium carbonate, gypsum and other salts.

The desert soils are highly susceptible to wind and water erosion because they are single-grained and easily detached. They are quite susceptible to erosion processes when disturbed by machines and removal of the vegetative cover.

Minerals

Most of the copper produced in the United States comes from this biome. Many very large, low grade deposits are being mined. Coal and phosphates are being mined in the eastern portion of the cold desert. Other mineral operations occur throughout the biome. These include, but are not limited to silica, gypsum, sodium, perlite, gold, mercury, trona, iron ore and tungsten. Oil shale extraction may begin in the eastern part of the cold desert. There are areas where the existence of hot springs and rock temperature gradients suggest that energy may be developed from geothermal sources. These are primarily in southern California, Nevada, Oregon and Idaho. The Federal Government has recently begun a program of leasing areas for geothermal developments.

Leasing and exploration activity is increasing, especially in the Great Basin portion of the cold desert. Nearly all of the current production of oil and gas in the desert biome is limited to the eastern edge of the desert in Wyoming, Utah, Colorado and New Mexico. The soil is

thin to nonexistent in large areas. There is more rock exposure on the surface than in the grassland and coniferous forest biomes. This feature attracts mineral prospectors and rock hounds and makes surface geological studies relatively easy and accurate.

Water

Parts of the Columbia-North Pacific, Great Basin, Upper Colorado and Lower Colorado drainage basins are located in the desert biome. The major rivers of the biome are the Snake, Columbia, Humboldt, Green and Colorado; they receive most of their runoff from precipitation in the higher elevations above the desert. Many streams within the arid desert biome are intermittent.

The Great Basin water resources region is a closed basin. Its surface waters drain into inland water bodies such as Great Salt Lake, Sevier Lake, Pyramid Lake and Humboldt Sink.

Runoff from the desert is low and fluctuates widely from one year to the next. Average annual runoff ranges from less than 0.1 inch in the most arid sections of the hot and cold deserts to more than 2 inches in less arid parts of the cold desert.

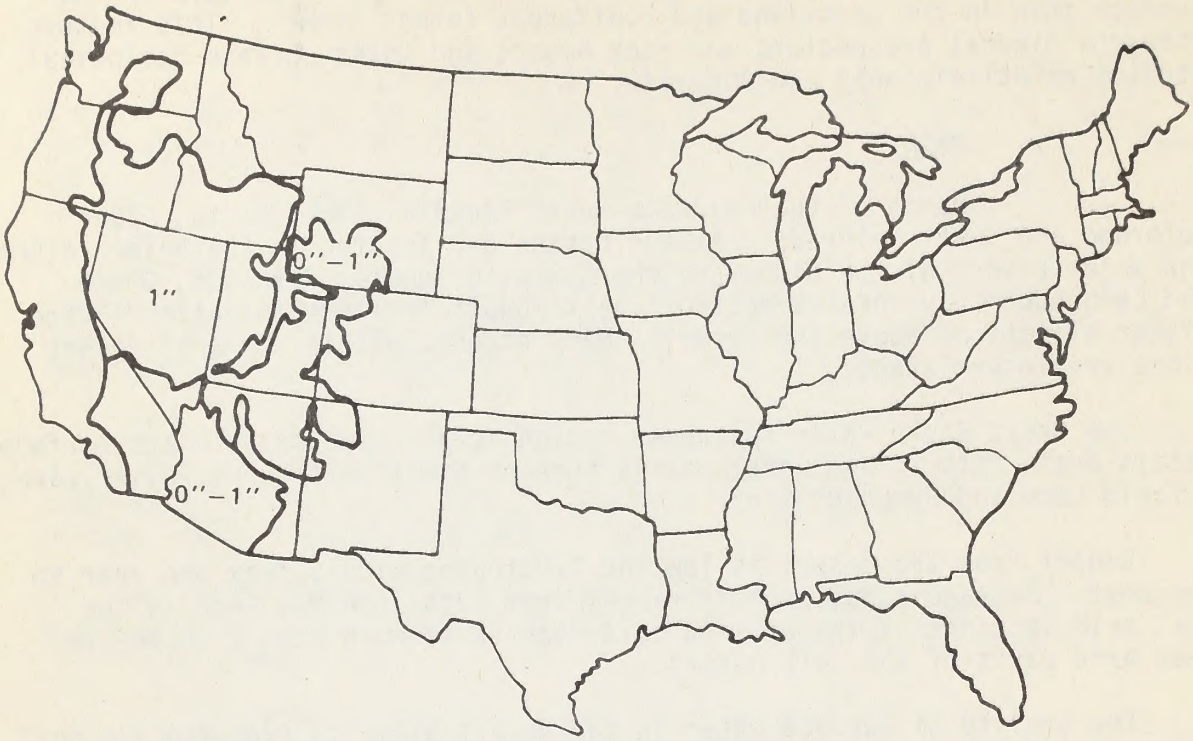
The quality of surface water in the desert biome is adequate for most purposes. However, in the lower Colorado region and Great Basin, some surface waters have high dissolved-solids content and/or suspended-sediment concentrations. Average dissolved-solids content ranges from less than 100 ppm in part of the Columbia-North Pacific region to more than 1,800 ppm in some areas of the Great Basin and Lower Colorado regions. Average suspended-sediment concentrations range from less than 280 ppm in part of the Columbia-North Pacific region to more than 30,000 ppm in northern Arizona and southwestern Utah. Suspended-sediment concentrations as high as 700,000 ppm have been measured during peak flows on some streams in the Colorado River system.

Climate

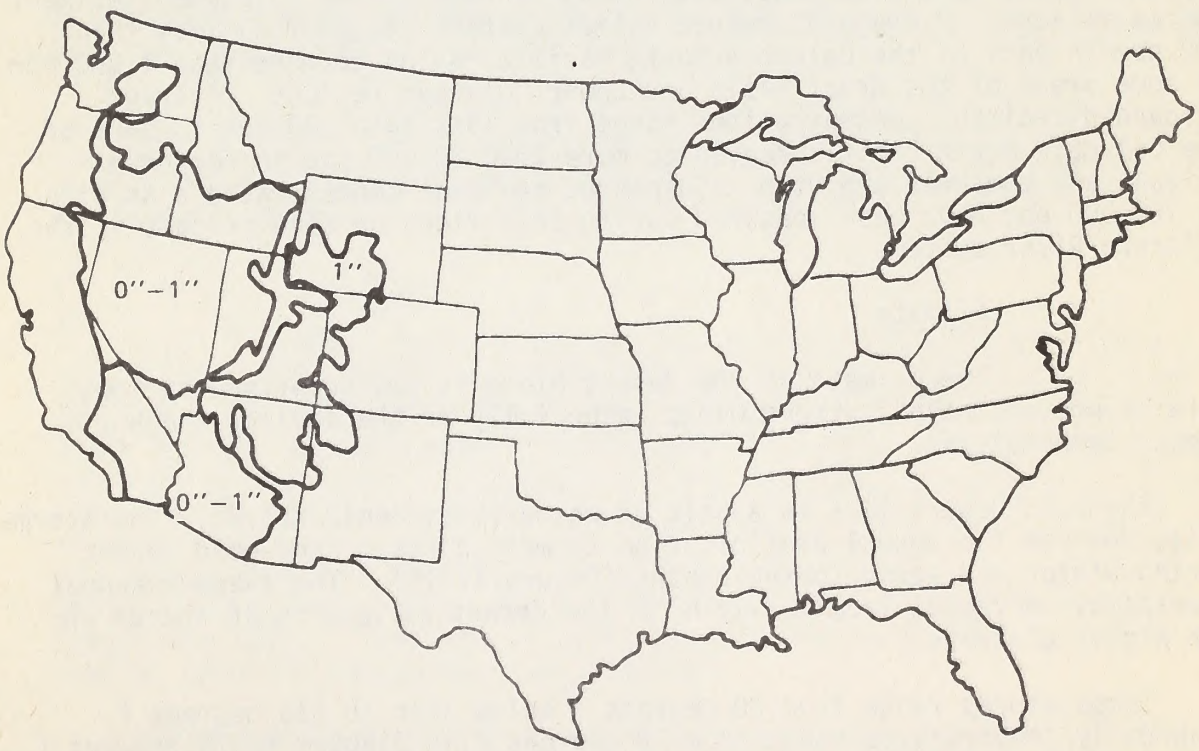
The climate of the desert biome is characterized by low, erratic precipitation, strong winds (especially in the spring) and hot summer temperatures.

The cold desert lies in a belt of westerly cyclonic storms. The storms bring most of the annual precipitation to most parts of the cold desert during winter and early spring months (Figure II-16). The average annual precipitation ranges from 4 inches in the desert valleys to 16 inches on the higher plateaus.

Temperatures range from 20 degrees F below zero to 115 degrees F. Mean daily temperatures range from 20 degrees F in January to 75 degrees F in July (Figure II-17).

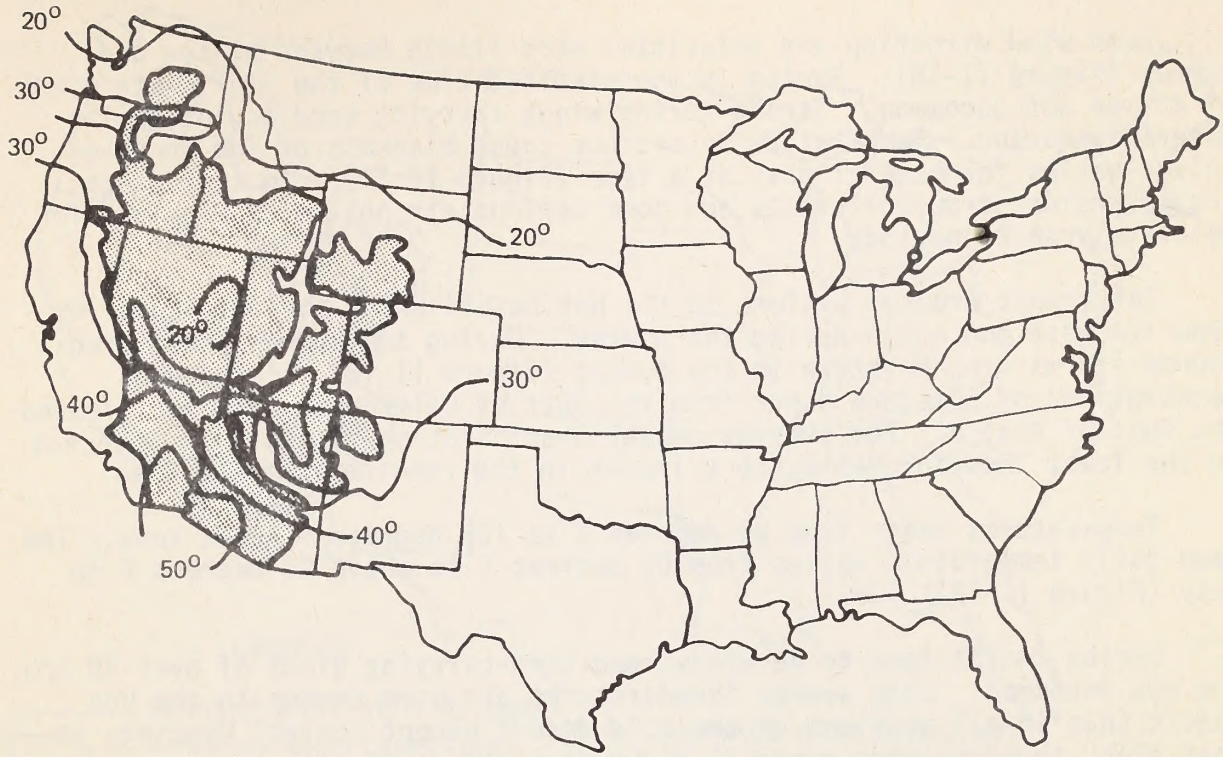


MONTHLY PRECIPITATION (INCHES)–JANUARY

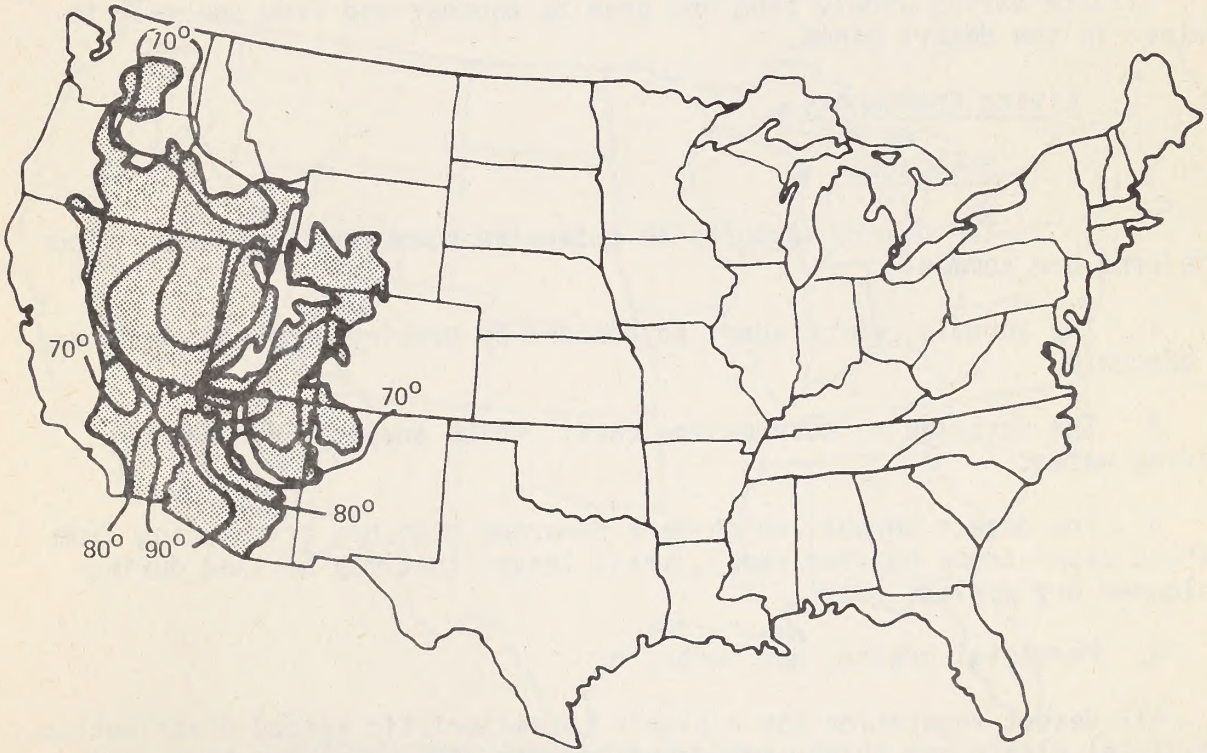


MONTHLY PRECIPITATION (INCHES)–JULY

Figure II-16. Average January and July precipitation in the desert biome



AVERAGE DAILY TEMPERATURE (0°F)—JANUARY



AVERAGE DAILY TEMPERATURE (0°F)—JULY

Figure II-17. Average daily temperatures in the desert biome in January and July

Mean wind direction and velocities vary little between winter and summer (Figure II-18). Spring is the windiest time of the year, with winds of 40 mph not uncommon. Strong spring winds carrying sand sculpture the desert landscape. Temperature inversions cause blankets of fog to cover inland basins for several days at a time (Figure II-19). In some areas, the inversions trap pollutants and pose serious air pollution problems for relatively short periods.

Infrequent frontal systems in the hot desert bring some moisture in from the west and north during the winter. During the summer, scattered thunderstorms drop moisture in the desert (Figure II-18). Infrequent penetrations of moisture occur from the Gulf of California, the Pacific and the Gulf of Mexico. The average annual precipitation ranges from 2 inches in the lower Imperial Valley to 8 inches in the remainder of the area.

Temperatures range from 25 degrees F to 125 degrees F above zero. The mean daily temperature varies from 55 degrees F to above 90 degrees F in July (Figure II-17).

Spring months tend to be windy, and sand-carrying winds of over 40 mph are not uncommon. Late summer thunderstorms are more common in the hot desert than in all sections of the cold desert except central Wyoming; in that area, thunderstorms occur 40 to 50 days per year.

Climate varies widely from one area to another and from one year to another in the desert biome.

Living Components

Vegetation

The desert supports an extensive community of plants. Four lifeforms are common:

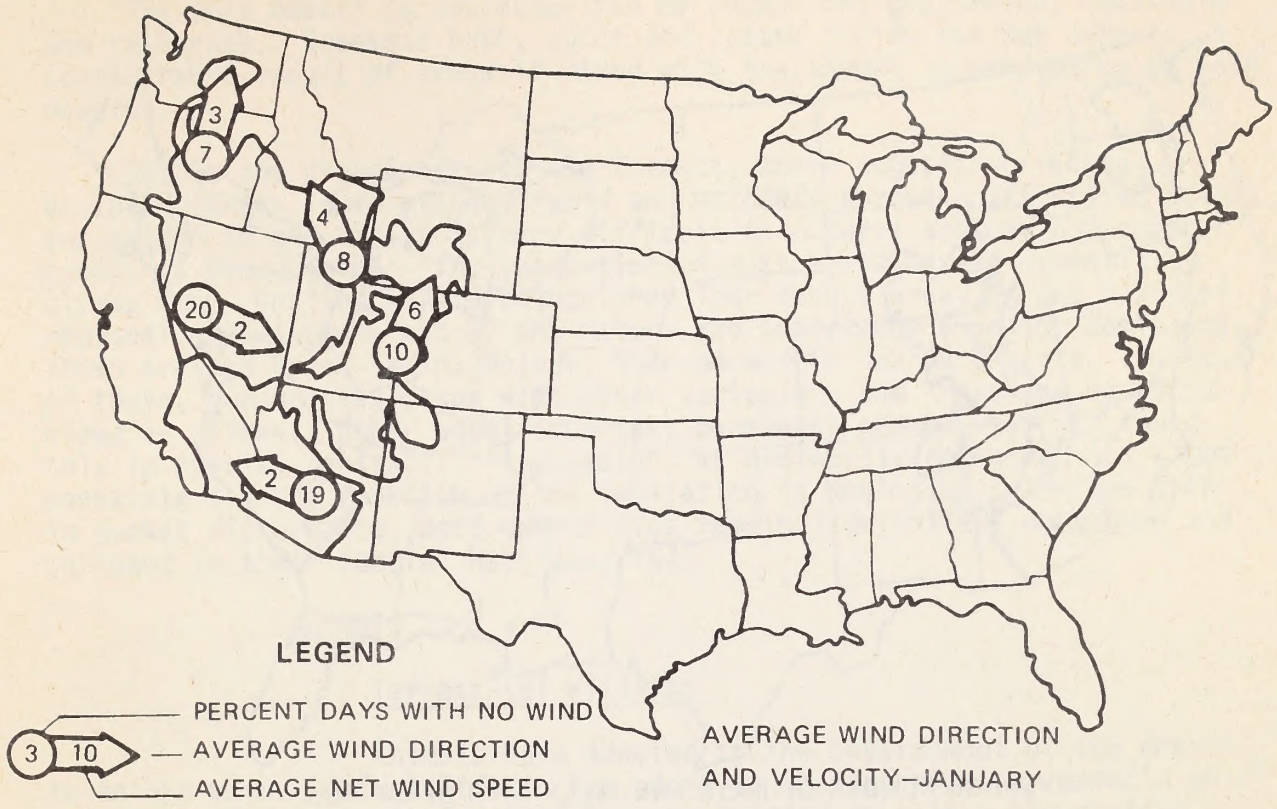
1. The annuals, which adapt to drought by growing only when moisture is adequate.

2. The succulents, such as the cacti, which adapt to drought by storing water.

3. The desert shrubs, which have numerous branches originating from a short basal trunk bearing small, thick leaves that may be shed during prolonged dry periods (2).

4. Perennial grasses and forbs.

All desert vegetation has a highly characteristic spaced distribution. Individual plants are thinly scattered and separated by large bare areas. The extensive bare ground, however, is not always free of plants. Mosses, algae and lichens may form a stabilizing crust and function as nitrogen-fixing agents.



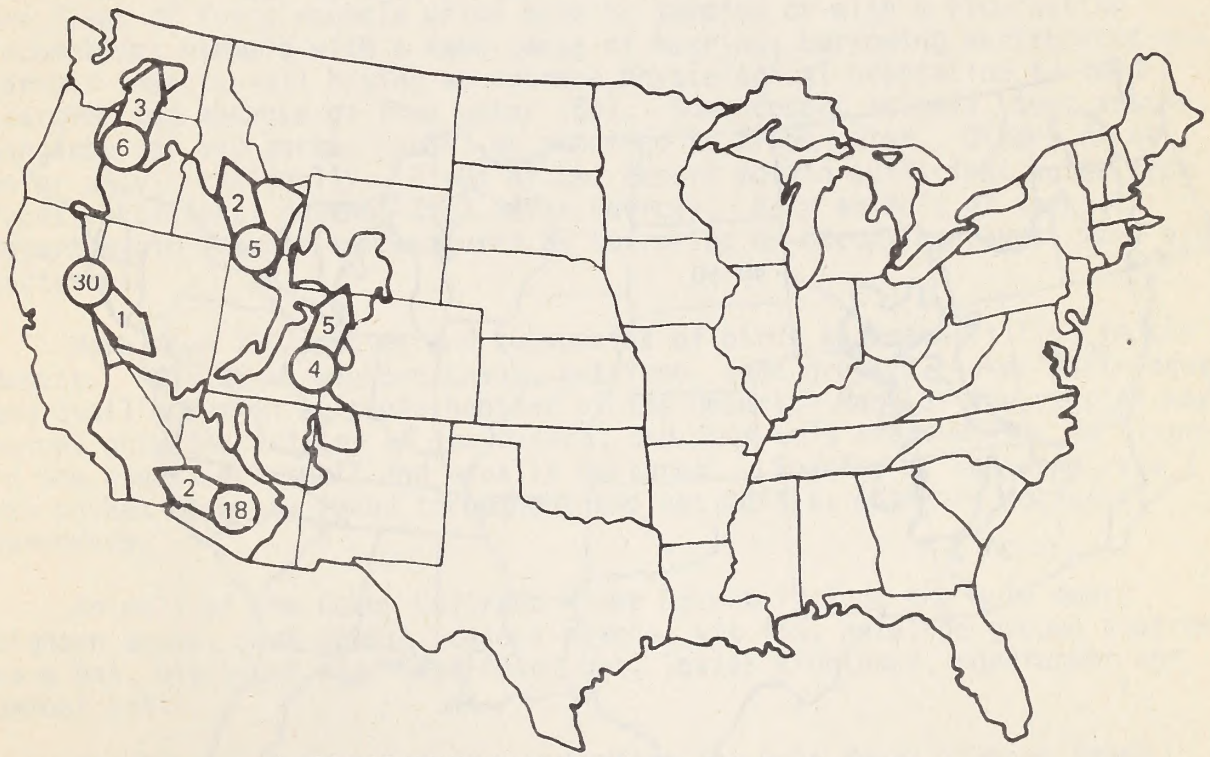
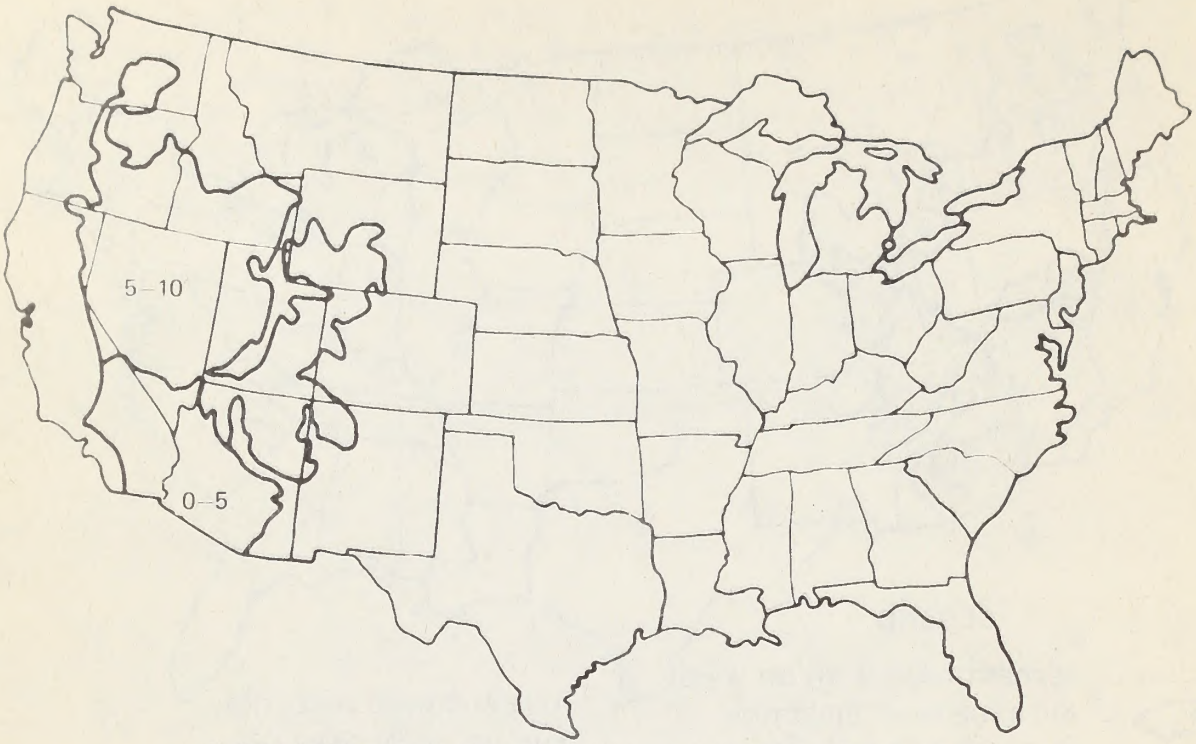
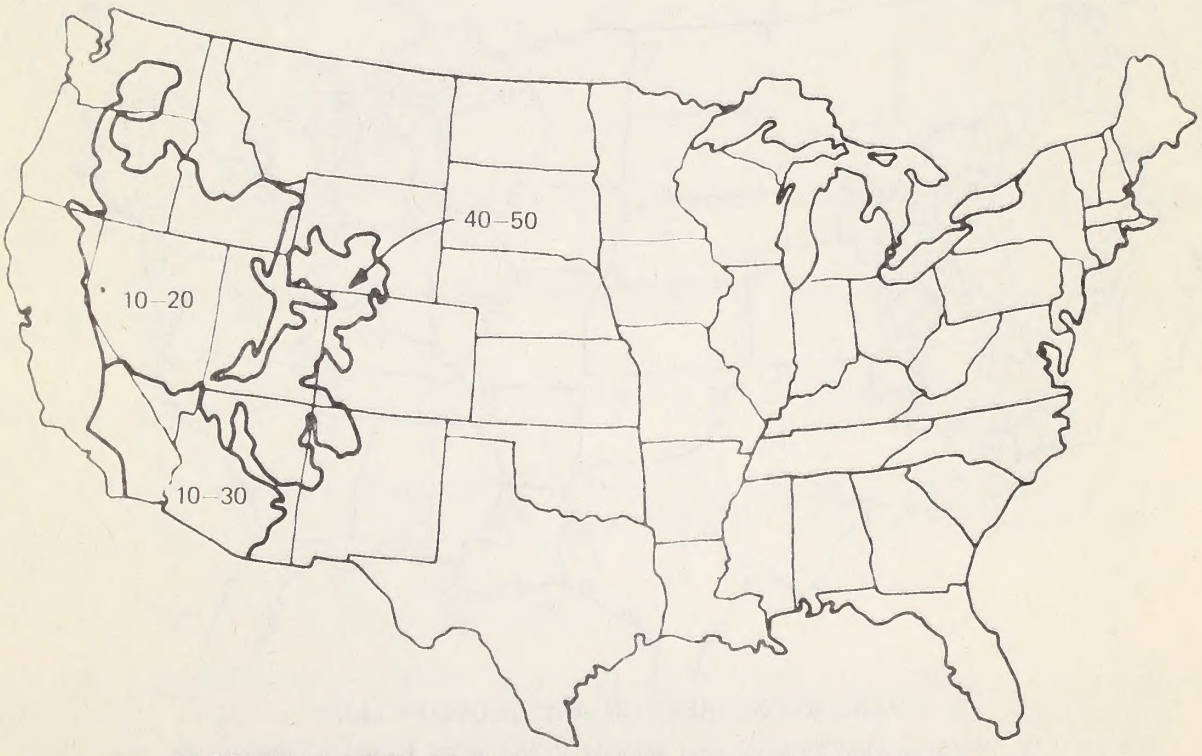


Figure II-18. Average wind direction and velocity in the desert biome in January and July



AVERAGE NUMBER OF DAYS ANNUALLY WITH DENSE FOG



AVERAGE NUMBER OF DAYS ANNUALLY WITH THUNDERSTORMS

Figure II-19. Average annual number of days with fog and days with thunderstorms in the desert biome.

The cold desert is characterized by sagebrush, greasewood, shadscale and saltbrush. Creosote bush, yucca and cactus typify the hot desert. A considerable amount of grass is mixed with the shrubs in many parts of both deserts.

Unlike the grasslands and the forests, where vegetative renewal on disturbed areas is relatively rapid and succeeds through distinctive stages, succession in the desert is very difficult to observe and may not occur except on floodplains. The vegetation on most areas may be essentially climax (3). Oosting (57) distinguishes four desert areas on the basis of regional environments and by the nature and importance of major dominants. These are the Great Basin, Mojave, Sonoran and Chihuahua deserts. In each of these, communities occur with minor variations and these may be recognized as climax. Other equal important permanent communities are found only in special habitats. "Succession, as ordinarily conceived, is almost nonexistent since reaction of the vegetation is negligible. Unless there is marked disturbance, most communities remain indefinitely unchanged and dominant in their special habitats" (57).

Animals

Terrestrial Wildlife

Animals have adapted to the environment of the desert in unique ways. Animal life in the biome is characterized by mammals which are fleet of foot; mammals which move by jumping or with a ricocheting locomotion; mammals with a keen sense of hearing; burrowing vertebrates and various insects--all having an extreme physiological adaptation to food scarcity and absence of free water (50). Some desert animals, such as the kangaroo rat and pocket mouse, do not need to drink water. Others drink water only occasionally. Birds of the desert obtain sufficient water from foods, occasional dew and free water sources. Many animals of the hot desert avoid extreme temperatures by burrowing or occupying caves; many are nocturnal.

More than 750 species and subspecies of birds and mammals live in the desert. Mule deer, bighorn sheep, antelope, sage grouse, chukar partridge and quail occur in suitable habitat of the desert. Many of the species may occupy only the fringes of the desert, and then only seasonally. Carnivores in the desert are small and usually nocturnal. Species of kangaroo rats and pocket mice are found throughout the hot desert; both are nocturnal burrowers.

Animals of the Lower Colorado River Desert include the mule deer, bighorn sheep, jack rabbit, desert coyote, kit fox, antelope ground squirrel, cave bat, big brown bat, leaf-nosed bat, lesser nighthawk, roadrunner and Gambel quail.

The Sonoran Desert provides a habitat for mule deer, bighorn sheep, the ringtail, spotted skunk, wood rat, peccary, Gila woodpecker, numerous small birds, bullsnake, three species of rattlesnake and eight species of

lizards. The Gila monster is typical of the tall cactus community. The river bottoms and flood plains include some 32 kinds of birds.

The Mojave Desert has fewer species of pocket mice and the Gila monsters are of more limited occurrence. Otherwise, many of the animals--with some differences in subspecies--are the same as those in the Sonoran Desert, with the desert iguana and desert tortoise being common. Death Valley, an example of desert habitat, has 39 desert mammals and approximately 100 species of birds (3). Certain insects perform critical functions in the desert, such as the Yucca moth which pollinates the Joshua tree.

Many of the hot desert animals are found in the sagebrush and shadscale of the cold desert. Major tenants, however, are the Great Basin coyote, badger, antelope, mule deer (locally), great horned owl, prairie falcon, Swainson's hawk, golden and bald eagles, horned lark and horned toad.

Aquatic Wildlife

Aquatic environments are limited in the desert biome. Diversions of water for agriculture and other uses have impaired some aquatic communities such as the deterioration of fish habitat in Pyramid and Walker Lakes, Nevada--the home of Lahontan cutthroat trout and the depleted cui-ui sucker (51).

Water quality varies from the high quality desert-mountain snow water to such low quality alkaline lakes as the Salton Sea.

Desert aquatic environments have been altered by the construction of large reservoirs--Lakes Powell and Mead--and many small irrigation and stock watering reservoirs. Exotic species such as black bass, crappie, carp, sunfish, coho salmon and striped bass have been introduced in some reservoirs. The Corvina, Sargo and Bairdiella have been introduced in the Salton Sea. Most of these introductions have been successful while many endemic species have declined.

Threatened or Endangered Wildlife (42, 51)

Many threatened or endangered species of wildlife are recognized in the desert biome. These include, but are not limited to: Utah prairie dog, Sonoran pronghorn, masked bobwhite quail, Yuma clapper rail, southern bald eagle, American peregrine falcon and Desert Slender Salamander.

There are more threatened species of fish in the desert than in any other biome. This is due in part to the many isolated watersheds and the precarious nature of many water bodies. Typical species include: Devil's Hole pupfish, Owens River pupfish, Woundfin, Pahrump killifish, Gila topminnow and Colorado squawfish.

Domestic Livestock

The desert biome produces a variety of forage species suitable for domestic livestock forage. Both cattle and sheep are grazed throughout the biome.

Because of variations in climate in the cold desert, livestock grazing may occur during any season depending on location. In the northern third of the biome, livestock grazing is very limited in the winter season because of severe winter storms. Spring and fall grazing is most common with some winter grazing of sheep occurring where the climate permits.

Parts of the hot desert are grazed by cattle yearlong. Some sheep grazing occurs, but it is limited to the winter season.

In about one year out of five, unusually abundant precipitation in the hot desert produces a good crop of winter annuals. Livestock grazing increases during the brief period the annuals are available.

Although forage is especially suitable for sheep grazing, the number of sheep in the desert has declined over the years generally because of economic factors.

Past trends in the number of sheep have definitely been downward throughout the desert biome. Between 1964 and 1969 the 11 Western States experienced an 11 percent decline in sheep numbers. The most likely explanation lies in consumer preference for other types of red meat and the substitution of synthetic fibers for wool. Other factors affecting the sheep industry are high labor costs, loss to predators, real estate opportunities and social mores.

Wild Horses and Burros

Bands of wild horses and wild burros roam several ranges in the hot desert uplands and remote areas of the cold desert.

The greatest number of wild horses and burros on NRL occur in the intermingled cold desert biome and the pinon-juniper type of the woodland-bushland biome. About 90 percent of the estimated 17,000 wild horses occur in this association, with Nevada having the most and the widest distribution. Competition with livestock and wildlife for forage does occur. Distribution of wild horses is limited to remote, less accessible portions of the public lands inhabited by deer and antelope. An estimated 10,000 wild burros populate the hot desert region of Arizona, California and Nevada, where competition for forage with other grazing animals may be locally significant.

Soil Organisms

Soil organisms play the same role in soil development in the desert biome as in the grassland biome. However, organic matter is more limited in desert soils and its breakdown by microorganisms such as nematodes

and protozoa is slower. Conditions for the growth and activity of the microorganisms is less favorable in the desert biome; although the soil is often warm enough, moisture usually is insufficient. Due to excessive salt concentrations, some desert soils are largely devoid of plant life and the microorganisms that would help develop conditions to support plant life (52).

Human

About 17 percent of the western states' population resides in this biome. Except for the hot desert region of southern Nevada, California and Arizona, the desert biome has one of the lowest population densities in the West--around five persons per square mile. Urban populations are clustered around the major trade and service centers such as Phoenix, Salt Lake City, Las Vegas, Reno, Boise and the urban areas of California.

In the rural areas, per capita income levels are about 85 percent of the western average, but relatively fewer families are below poverty levels due to lower living costs. In spite of the low incomes, most of the biome experienced a net population gain during the 1960-1970 period. Population increased from 1960 to 1970 by 29 percent or an average annual increase of 2.9 percent, which is slightly above the Western States' average.

The entire area is dependent upon a limited water resource. Principal industries in rural parts of the biome are agriculture and mining. Urban centers tend to be new and modern, with growing manufacturing and service oriented industries. The Reno and Las Vegas areas have expanded entertainment and tourist service into a major industry (53).

One of the reasons for significant population and economic growth in the biome during recent years has been its "amenity" resources: clear air, warm and cloudless weather, low population and ready access to outdoor recreation areas. Tourism and recreation are growing rapidly. Subdivisions and sale of lands for retirement or recreational use are mushrooming in many rural areas. In urban areas, the "quality environment," ready access to services, educational institutions and a labor market form a magnet for industries for which ties to raw material sources or national market centers are not a major constraint. Typical of these are apparel, electronics and aircraft industries (54).

The livestock industry of the desert biome ranks between the grassland and coniferous forest biomes in terms of economic importance to local incomes. However, the livestock industry in this biome is much more dependent on national resource lands as a source of feed than in either of the other two. For example, in the Great Basin Area (central and northern Nevada, western Utah, southwestern Idaho and southeastern Oregon), the national resource lands account for about 60 percent of the total land areas and provide about 20 percent of the total livestock feed. On the other hand, in the hot desert area, national resource lands account for about 38 percent of the land area, but provide only around 3 percent of the feed consumed. The high concentration of feedlot operations in this region accounts for

much of the difference between the two regions. For the biome as a whole, the NRL supply 5,990,000 cattle AUM's and 1,970,000 sheep AUM's.

Ecological Interrelationships

Desert ecosystems are exceptionally vulnerable to improper use and may reflect this quickly through accelerated wind erosion and in other ways. Recovery rates are slow. Although the desert has been the subject of many studies and books, the interrelationships of the desert ecosystems are not well known. Additional studies are needed, especially in view of the delicate ecological balances of the desert ecosystems. The disturbance of vegetative cover and loosening of soil, as in road construction, can result in rapid invasion of such non-native plants as halogeton, causing an entirely different ecological relationship in the immediate area.

Precipitation is low in desert ecosystems and varies considerably from year to year. Evapotranspiration is high, particularly in the hot desert and southern portions of the cold desert. The limited soil moisture in southern parts of the desert limits the potential for production of living components of the ecosystem.

Solar radiation is high in the desert, but the amount of energy captured by photosynthesis is greatly reduced due to the limited moisture and sparse vegetation. Such factors reduce the productive capacity of the desert and shorten the food chain.

The nutrient cycle occurs slowly in the desert because of the slow rate of decomposition. Large quantities of nutrients are tied up in the shrubby vegetative biomass. Man's use of the desert has altered the balance of the nutrient cycle in some areas. Additional data are needed to fully understand this component of the ecosystem and analyze impacts.

Natural successional recovery of desert communities from man-caused disturbances is extremely slow, especially in the hot desert.

Land Uses

Most of the land in the desert biome is owned by the Federal Government. Extensive areas are used for military operations and other government purposes, such as Atomic Energy Commission test grounds. Most of the Federal lands in the biome are national resource lands administered by the Bureau of Land Management.

The native vegetation covering a major part of the biome is used for livestock grazing, the most extensive agricultural activity in the biome. Both cattle and sheep are grazed in the desert. The former are primarily cow-calf operations; the latter are oriented toward lamb production. Natural vegetative productivity for grazing decreases, generally, from north to south in the biome. Parts of the hot desert are marginal grazing lands, and some areas are unsuitable for livestock use.

Irrigated crops in the cold desert include potatoes, sugar beets, grains and hay. Subtropical fruits, cotton and specialty crops are grown in the hot desert. Large areas of irrigable soils remain unirrigated in the desert because of inadequate water supplies.

A few areas in the biome have been formally designated and managed as wilderness, primitive or roadless areas. Additional areas containing native vegetation and lacking significant development (such as roads, buildings or other facilities) may be considered for formal designation as land use planning progresses.

Mining was responsible for much of the original settlement of the biome. Many of the early towns started as gold or silver camps. Mining continues today to be a primary industry in the States of Colorado, Arizona, New Mexico, Utah and Wyoming. The exploration and production of oil and gas make a significant impact on the economy and environment in the desert biome.

The desert is extensively used for outdoor recreation. Heaviest use occurs near large population centers. The western part of the hot desert adjacent to the Los Angeles-Las Vegas-Phoenix urban areas receives extremely heavy use.

The limited surface waters in the biome are heavily used for recreation activities. Heavy offroad vehicle use is occurring close to urban areas.

Metropolitan areas in the desert have grown rapidly in recent years. The Las Vegas urban population increased 165 percent between 1960 and 1970 (48). The urbanized area increased from 35 square miles to 121 square miles. Other metropolitan areas such as Phoenix and Salt Lake City experienced similar growth. The extraordinary growth of metropolitan areas in the desert may continue for several decades. If so, large areas of adjacent rural land may be required for expansion.

Urban areas in the biome are separated by vast areas of open space.

Smaller cities serving a local market area or developing a tourism-recreation industry probably will experience an increased demand for residential, commerical and industrial land uses.

Demand for recreational or retirement homesites in remote areas probably will continue to increase.

Hazards

Plants poisonous to wildlife and domestic livestock occur at various seasons throughout the biome. The general description of characteristic occurrences of poisonous plants in the environment is discussed in the grassland biome. Throughout the biome and especially in those areas where historic prospecting and mining for gold and silver took place, mine shafts, portals and pits, present significant hazards to the public, particularly unsuspecting recreationists.

Aesthetics

The term "desert" for many people carries with it a connotation of sand dunes and desolation. While it is somewhat inhospitable for man, the connotation is far from accurate. It may, however, be partly responsible for the lack of development and use of the desert in the past. People are just now discovering the desert for the wide variety of interest it really has. There are sand dunes in both the cold and hot deserts, but they involve a very minor part of the area as a whole. The dunes are one more interesting facet of the desert that people are finding more and more enjoyable.

Although there are many similar characteristics throughout, the desert biome can be more clearly described in the two separate sections.

The land form of the cold desert is typically the flat dry bed of an ancient lake or the relatively low rolling hills of the Great Basin, occasionally interrupted by a small mountain range. In southern Idaho and Oregon the land form is broken by considerable areas of rimrock and often cut by deep canyons. Seldom is the observer out of sight of a mountain somewhere in the area of view. Texture of the cold desert is generally the relatively soft texture of the vast expanses of sagebrush broken occasionally by a bare ridgeline, a steep gully or a flat dry lakebed.

Except for dawn and sunset, color is rather monotonous in the cold desert. It is generally dominated by the gray-green of sagebrush or the flat grays and browns of the soil typical to the region. Soil color becomes a more important factor in some portions of the cold desert such as in Wyoming and Colorado and New Mexico where the red sandstones make up the parent material.

Lines play a very minor role in the makeup of the character of the cold desert. Lines that are evident are primarily those caused by man: roads, fences and powerlines that occasionally cross through the area. Although these intrusions are few, they are obvious for many miles.

As in the grassland, scale is difficult to define. Vastness of open space with few vertical elements in the landscape make it hard to tell just how far an observer is from a given object.

The character of the hot desert is considerably different than that of the cold desert. Form is more often remnants of eroded mesas with broad flat valley bottoms. Where live streams run through the desert, they often are actively eroding the land; and steep, sometimes vertical-walled canyons are incised into once flat mesas. Prime examples of this area are the canyons of the lower Colorado River.

There are distinct horizontal and vertical lines evident in the mesa tops and sharp drop-offs to the valley floors. Color becomes a dominant factor in the hot desert. Rich reds and browns of exposed soil and rocks are much more in evidence than in the sage-covered cold desert.

Texture is fairly coarse because of the widely scattered vegetation. Rock and soil are exposed over much more area.

Scale is much easier to define in the hot desert. Vertical lines created by edges of eroding mesas along with the larger and more scattered vegetation provide the observer with the elements needed to more accurately judge size and distance.

Sounds are quite important in the desert biome. The fact that sound travels great distances because of sparse vegetation and long uninterrupted stretches of topography is important to the visitor. In many areas, silence is unique to the desert.

Human Interest Values

Geological

Deserts have some of the most monotonous sightseeing geology and some of the most intriguing. The basin and range areas of Nevada tend to be somewhat repetitive with long sweeping views of the basins and short quick trips through the mountain ranges.

Certain areas, particularly the Colorado Plateau, are highly eroded, mostly in colorful formations which contain delicate erosional features, easily recognizable "picture book" geological structures, and grand views of the total. Scattered throughout the biome are some of the most magnificent canyons in the world, the Grand Canyon, the canyons of the Snake, the Owyhee, the Green and others. Also present are sand dunes, volcanic features, playas and fault structures.

Archeological

In the desert biome are found remnants of both Big-Game Hunting Tradition and Old Cordilleran Tradition cultures, the former to the east and south and the latter to the north and west. Hunters in southeast Arizona hunted mammoths along with other big game. People in the Nevada desert were mostly gatherers, but did hunt small game, including waterfowl, around the many Pleistocene lakes in the region.

These two traditions developed into what is termed the Desert Culture Tradition, a basic gathering culture that existed on the many grasses, pinons, insects, small game and other products of the hot and cold deserts.

From this desert archaic base there developed, as the result of strong influences from the valleys of Mexico, several agricultural cultures in the hot desert and the southern portions of the cold desert.

Irrigation farming was practiced, large communal structures constructed, and highly organized and structured social systems developed. At the same time period, there also were people with the Desert Archaic Tradition still

coexisting and others like the Apachean groups moving into the desert area. This was the situation at the time of first non-Indian contact (by the Spanish explorers) in the early 1500's.

Large archeological sites of the desert biome are quite easy to detect, but attention paid to these sites tends to allow other, less pretentious sites like agricultural terraces, campsites, chipping areas, small canals and shallow caves to be destroyed.

There is almost a one-to-one relationship between archeological sites and water sources in the desert. Water sources were as important to prehistoric man as to modern man.

Historical

Like most of the West, history of the desert biome is generally so recent that some individuals still living there have seen 90 percent of the important historical events that have taken place.

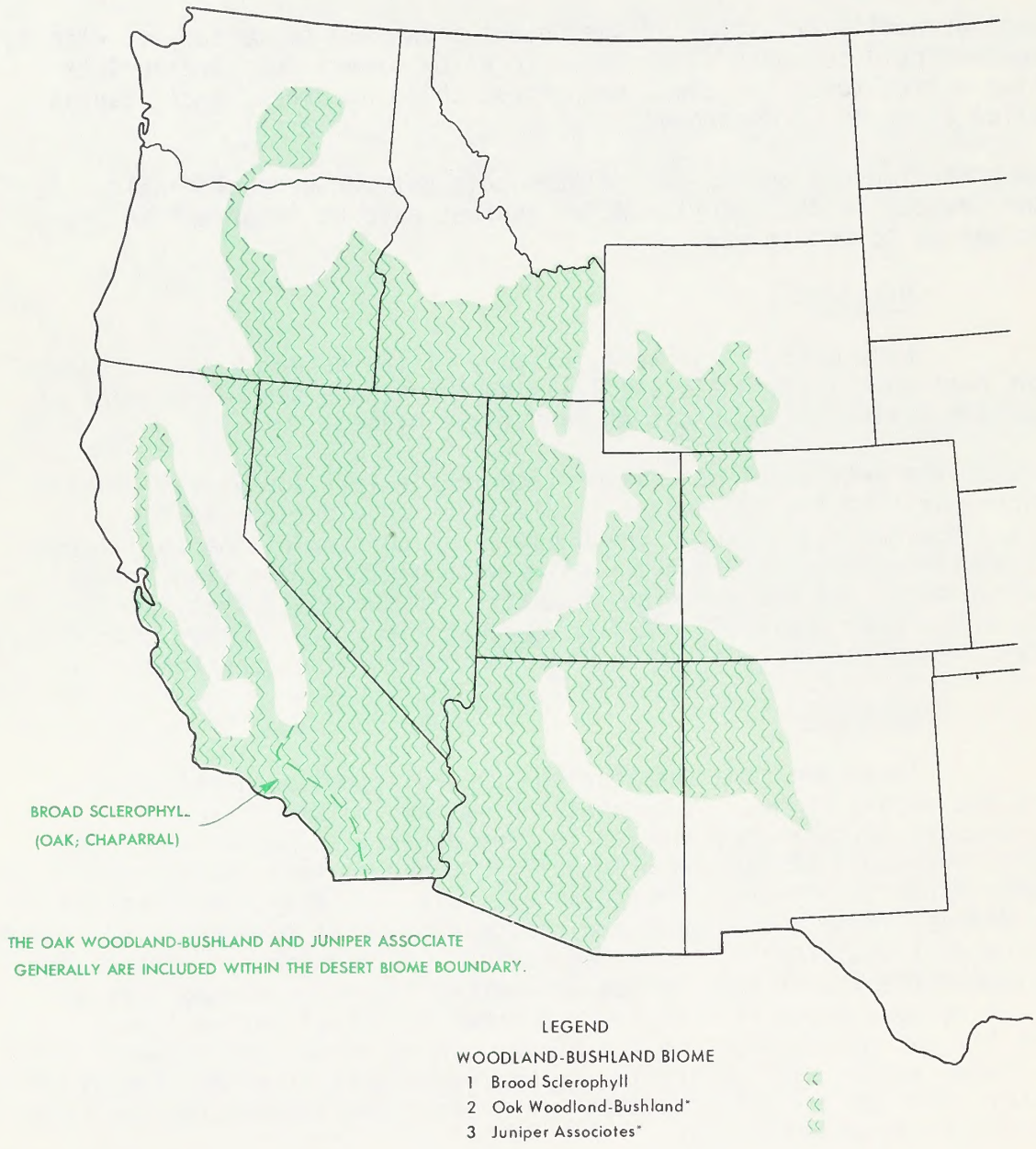
Most of the settlement has taken place in the last 100 years. Only in southern parts of the hot desert is civilization older due to the Spanish and Mexican settlement. The Great Basin portion of the cold desert is the least inhabited area in the country with history revolving around mining ghost towns and the ranching industry. In the hot desert, irrigation agriculture has been a way of life from prehistoric times. Other than these influences, historical values are similar to those of the grasslands.

Cultural

There are some interesting cultural-ethnic and religious groups in the desert biome. Throughout the western United States a "rancher-cowboy" culture predominates in many areas. In Nevada and southwest Idaho are groups of Basques originally brought to this country as sheepherders from the Pyrenees Mountains of Spain. In Utah, and parts of Arizona, Nevada, Idaho and Wyoming are concentrations of Mormons, a religious group which is a minority in the United States, but a majority group in the desert biome. The Yaquis near Tucson are native Americans living here as a political refugee group from Mexico. A great number of native Indian Americans live on reservations in the biome. These range from farmers like the Pimas and Papagos to hunting-gathering peoples like the Yavapai and Paiutes. All of the Indian groups have a strong attachment to the lands around their areas of settlement.

Woodland-Bushland Biome

The woodland-bushland biome (or biological community) occurs in many parts of the western United States. It is discontinuous, occurring as biological islands at higher elevations within the grassland and desert biomes. It also forms a transitional zone between those biomes and the coniferous forest biome. Its general range is shown in Figure II-20.



(*Generally included within the desert biome boundory.)

FIGURE II-20 WOODLAND-BUSHLAND BIOME

Many of its vegetative characteristics are similar to the cold desert. Figures II-21, 22 and 23 illustrate the oak woodland-bushland, broad sclerophyll and the pinon-juniper communities, the three species associations in the biome.

Non-Living Components

Topography

Much of the woodland-bushlands are located on the high hills and mesas in and adjacent to the deserts. The description of the topography of the desert biome applies to much of the woodland-bushland biome.

The woodland-bushland in California is located in the foothills surrounding the San Joaquin Valley and the mountains and foothills of the southwestern part of the state.

Soils

Soils in most of the woodland-bushlands have a slightly higher organic content, are more stable and are less susceptible to erosion than most soils in the desert. The description of the soils in the desert biome applies to much of the woodland-bushland biome.

Most of the woodland-bushland soils around the San Joaquin Valley are Aridisols with warm-dry surfaces. The soils in the foothills along the west coast are either Entisols or Mollisols and also have warm, dry surfaces.

Minerals

Coal occurs in parts of eastern Utah, Colorado and New Mexico. Deposits of uranium also occur in these areas. Vast deposits of oil shale occur in Colorado, Wyoming and Utah. Oil and gas are found in Wyoming and in the four corners area of Colorado, Utah, Arizona and New Mexico. Other oil and gas fields are scattered throughout the biome. The famous mother-lode country of California is in the bushland region of the biome.

Water

Water resources vary considerably from one area to another in the woodland-bushland biome. Most of the surface water is supplied by rivers and streams with headwaters in the forests above the woodland-bushland.

The woodland-bushland areas generally receive from 12 to 25 inches of mean annual precipitation; however, the California oak-chaparral receives up to 50 inches per year. Both intermittent and perennial streams are found in the woodland-bushland areas. The intermittent streams are particularly common in juniper woodlands. Flood waters of intermittent streams generally carry considerable silt. High-intensity summer thunderstorms are typical of the juniper areas and flood runoffs are common.



Figure II-21. The broad sclerophyll (oak-chapparal) community



Figure II-22. The oak woodland-bushland community



Figure II-23. The pinon-juniper community

Where annual precipitation averages from 10 to 15 inches per year, annual runoff ranges from 0.1 to 5.0 inches per year. Where an average of 15 to 25 inches of precipitation falls per year, annual runoff may range from 0.5 to more than 10 inches. In the California oak-chaparral area, average runoff may be as high as 20 inches.

The quality of most surface waters within the woodland-bushland areas is generally acceptable for most uses. However, some streams in juniper areas have a high silt content. Average dissolved-solids content in surface waters ranges from less than 100 ppm to more than 1,800 ppm. Average sediment concentration of streamflow varies from less than 280 ppm in the oak woodlands to more than 30,000 ppm in some of the juniper associate areas.

Climate

Climate conditions vary significantly within the woodland-bushland biome. The woodlands east of the Sierra Nevada range are comparatively dry because of the mountains' rain-shadow effect; woodlands in the California foothills are influenced by moisture-laden marine air.

In the woodlands on the foothills above the cold desert, about 75 percent of the annual precipitation falls during the winter. In the woodlands above the hot desert, the precipitation is somewhat even throughout the year; the months of July and August bring the most rain. The average annual precipitation ranges from 10 to 20 inches.

Temperatures range from 20 degrees F below zero to 100 degrees F above; the mean daily temperatures vary from 20 degrees F in January to 85 degrees F in July (Figure II-25).

Windiness, especially in the spring, is characteristic of the woodlands in the desert foothills. Dust devils frequently accompany thunderstorms on hot days (Figure II-26). Winds of 40 mph are not uncommon. Fogs usually occur only in small basins.

Winter storms bring most of the precipitation to the woodland-bushland lands in the California foothills (Figure II-24). The months of June, July, August and September are dry. Average precipitation ranges from 20 to 40 inches in the north and from 10 to 20 inches in the south.

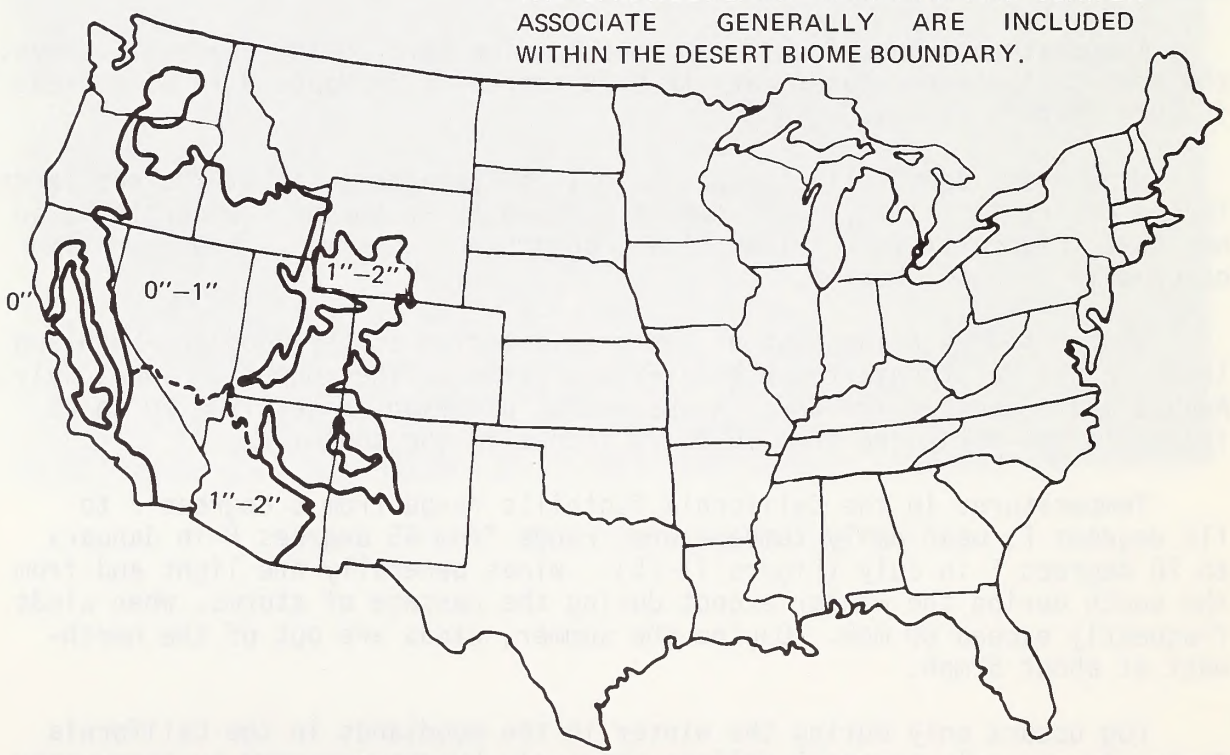
Temperatures in the California foothills range from 5 degrees F to 112 degrees F; mean daily temperatures range from 45 degrees F in January to 70 degrees F in July (Figure II-25). Winds generally are light and from the south during the winter except during the passage of storms, when winds frequently exceed 80 mph. During the summer, winds are out of the northwest at about 5 mph.

Fog occurs only during the winter in the woodlands in the California foothills and only in small valleys where air becomes trapped by topography. Thunderstorms occur about 5 days out of the year (Figure II-26), generally in the late spring or early fall.



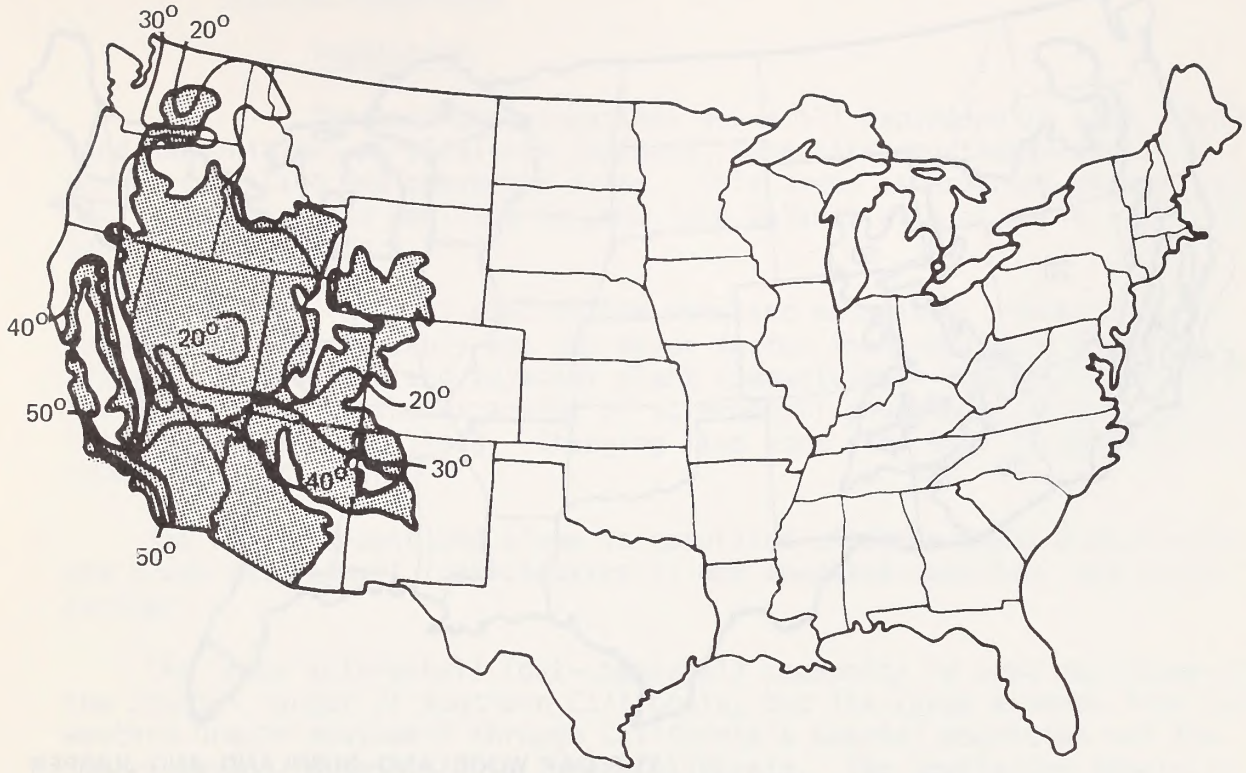
MONTHLY PRECIPITATION (INCHES)–JANUARY

THE OAK WOODLAND–BUSHLAND AND JUNIPER ASSOCIATE GENERALLY ARE INCLUDED WITHIN THE DESERT BIOME BOUNDARY.



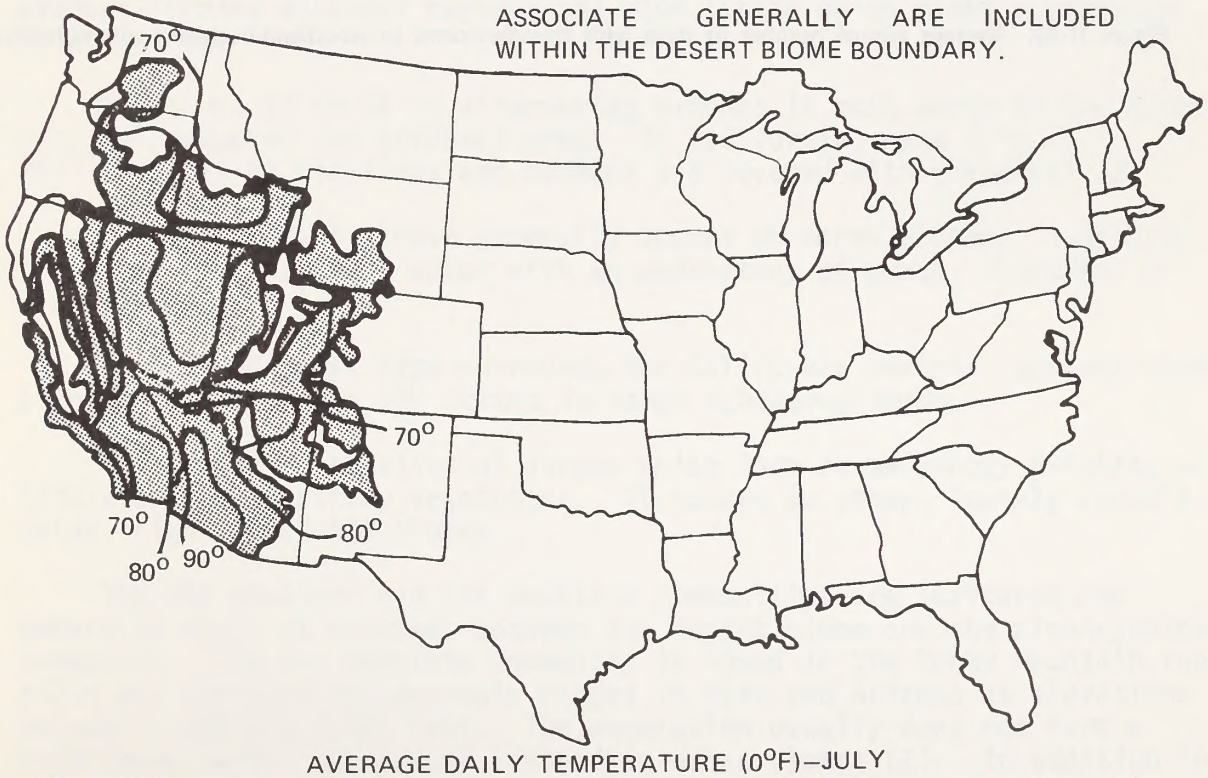
MONTHLY PRECIPITATION (INCHES)–JULY

Figure II-24. Average January and July precipitation in woodland-bushland communities



AVERAGE DAILY TEMPERATURE (0°F)—JANUARY

THE OAK WOODLAND—BUSHLAND AND JUNIPER ASSOCIATE GENERALLY ARE INCLUDED WITHIN THE DESERT BIOME BOUNDARY.



AVERAGE DAILY TEMPERATURE (0°F)—JULY

Figure II-25. Average daily temperatures in woodland-bushland communities in January and July



THE OAK WOODLAND–BUSHLAND AND JUNIPER ASSOCIATE GENERALLY ARE INCLUDED WITHIN THE DESERT BIOME BOUNDARY.

Figure II-26. Average annual number of days with thunderstorms in woodland-bushland communities.

Living Components

Vegetation

The woodland ecosystems are still expanding in size. Woodland communities, particularly junipers, have extended themselves into former grassland and sagebrush sites. This trend is expected to continue until land uses are modified to come into balance with climatic, site and environmental factors.

Fire is an integral part of the woodland ecosystem. Under natural conditions, fire probably was the major factor in maintaining a balance between the woodland and adjacent plant communities. Modern fire control has contributed to the expansion of sclerophyll and pinon-juniper woodlands into grass and brush types. Changing land uses also have allowed woodland communities to expand.

The woodland-bushland biome is comprised of three broad communities; the broad sclerophyll (oak-chaparral); oak woodland-bushland; and pinon-juniper.

The broad sclerophyll (oak-chaparral) community is best developed on the coastal ranges of southern California, but its range extends from southwestern Oregon southward through California's coastal mountains and the Sierra Nevada foothills into lower California. The vegetation generally consists of trees or shrubs with hard, thick evergreen leaves. The sclerophyll forest, woodland and chaparral life-forms merge with one another without forming distinct regions and with little or no plant succession relationship.

Chaparral is found in alternating patches in most parts of the community and occupies the greatest area. In California, some 5 to 6 million acres of hillsides and canyons are covered with chaparral (2).

The sclerophyll forest generally occurs on north slopes. Scattered trees or woodland types occur with an understory of grass, chaparral or sagebrush.

A woodland-grass type surrounds the California prairie, extends north along the Coast Range and occurs in other scattered areas.

The chaparral consists of shrubs which form dense canopy thickets with little or no understory vegetation. It occurs on steep, loosely consolidated, highly erodable slopes.

The oak woodland and oak bushland communities are scattered and generally occur as ecotones between the desert biome and the pinon-juniper community. The oak bushland community is found in the Rocky Mountain foothills and the interior mountain ranges in Utah and Arizona at elevations between 5,000 and 8,000 feet. The vegetation usually does not form a continuous cover, but occurs instead in dense clumps (2). In addition to

oak, the vegetation generally consists of many species of deciduous shrubs. The composition of the shrubs is dependent upon elevation, topography and aspect. "The number of plant dominants is large with several species appearing regularly in each community" (3, p.295).

The oak woodland community occurs in southern Arizona and New Mexico. Oak, juniper, small trees, undershrubs and grasses are interspersed in the community. Understory vegetation ranges from cacti and yucca to grasses and shrubs. Topography usually is steep to rolling and soils generally are erosive.

The pinon-juniper communities cover an area of approximately 60 million acres interspersed through the cold desert. A majority of the type occurs in Nevada, Utah, Colorado, Arizona and New Mexico.

Pinon-juniper generally occurs at elevations between 5,000 and 7,000 feet. Stand density varies from a very few trees per acre to 600 or more per acre. An open stand is typical, but dense stands are not uncommon. Stands often thicken progressively from scattered trees at lower elevations to maximum densities just before the vegetation changes to timber or mountain shrub types. The lower, sparse stands are frequently developed on sagebrush or desert grass sites. Since junipers are more drought resistant, they are commonly found at elevations 500 feet lower than pinon. Broad areas with savannah characteristics occur in New Mexico and Arizona; the understory is comprised of mixed desert grasses and shrubs.

The herbaceous undercover varies inversely with the tree and shrub density. However, studies in Arizona indicated that shrubs may increase with the number of trees until a tree density of 50 percent is reached.

The shrub undercover decreases sharply where tree canopy exceeds 60 percent ground cover (55).

Animals (1,42,43,56)

Terrestrial Wildlife

Few animals are restricted to the pinon-juniper-woodland. Birds such as the pinon jay and the gray flycatcher are characteristic species of this biome. Juncos are general inhabitants during the winter months. In the Kaibab-Zion area, the mule deer is dominant. The mountain lion, coyote and bobcat are the principal predators. The desert wood rat and the rock ground squirrel are characteristic residents. The nocturnal pinon mouse is perhaps the most abundant mammal found throughout the woodland. The cliff chipmunk, black-tailed jack rabbit and Nuttall's cottontail are of common occurrence. Nesting birds include the golden eagle, redtailed hawk and scrub jay.

The number of reptiles in the pinon-juniper is limited; they are most common at lowest elevations. Reptiles include the sagebrush swift, several lizards and the rattlesnake and kingsnake.

More mammals occur in the oak woodland of southern Arizona and New Mexico than in the pinon-juniper type. They include the ring-tail, white-tailed deer, mule deer, peccary, coatimundi and fox squirrel. Birds common to the biome include scaled quail, Mearns quail, turkey and mourning dove. Forty-two permanent resident birds, at least 16 species of lizards and as many snakes have been listed.

In the oak bushland, mule deer and coyotes are prominent. The long-tailed weasel and spotted and striped skunks are common. Hibernating mammals include the jumping mouse, marmot and Uinta and golden-mantled ground squirrels. Robins, jays and chickadees are common. Large, mixed flocks of birds winter in canyon bottoms or other sheltered locations. Of 11 reptiles in the community, only the rubber boa appears to belong primarily to the bushland.

Several subspecies of mule deer range throughout the broad sclerophyll community. Typical mammals include the mountain lion, bobcat, coyote, gray fox, wood rat, skunk and brush rabbit. The Merriam chipmunk, California mouse and five-toed kangaroo rat are confined to chaparral. Many small birds and lizards live in the community and amphibians include the tree frog and certain salamanders.

Aquatic Wildlife

Aquatic wildlife forms are characterized by cold and warm water fish species. A variety of aquatic environments exist in small, sometimes intermittent streams, upper reaches of larger rivers, impoundments and some natural lakes.

Waters are moderately rich in nutrients and microorganisms; water quality may be fair to good. Some streams may carry heavy silt at times in brushland areas; the better quality and more stable waters are located in wooded areas.

Representative fish are trout, whitefish, catfish, suckers, carp, squawfish, shiners, minnows, dace, chubs, sculpins, sunfish, perches, basses and pikes.

Threatened or Endangered Wildlife (42)

Threatened or endangered species of wildlife recognized in the woodland-bushland biome include at least the California condor and the peregrine falcon. Other such species which range into this biome are Utah prairie dog, San Joaquin kit fox, blunt-nosed leopard lizard, Colorado squawfish, humpback chub and Woundfin.

Domestic Livestock

Livestock distribution and use in the woodland-bushland biome is similar to that in the desert biome. The pinon-juniper type serves as spring and fall range for both sheep and cattle and as summer

range for cattle only in some areas. Some winter sheep grazing occurs in the southern half as well as some yearlong cattle grazing. Horse grazing is minor, although portions of some wild horse areas are located in this biome.

Most of the forage species in the broad sclerophyll community are winter annuals. Therefore, most grazing occurs during the winter and early spring.

The number of cattle in the biome has been increasing and the number of sheep has been declining for several years. The number of domestic horses has leveled off after declining sharply.

Most ranches are cow-calf operations. Sheep ranches place emphasis on grass-fat lambs. In the broad sclerophyll community, many cattle ranches run steers or yearlings because of the seasonal nature of the forage.

Wild Horses and Burros

The range of wild horses throughout the desert biome includes associated habitat inside the pinon-juniper regions of the woodland-bushland biome. Those horses restricted to rugged inaccessible areas of pinon-juniper are seldom observed by humans. Burro populations occur only in small isolated numbers in remote sectors of the biome. Official reports show barely 100 head of wild burros throughout the biome.

Human

The population and economic aspects of this biome are dominated by the California coastal range, from San Francisco to San Diego. Over 46 percent of the total population of the 11 Western States reside in this region mostly in urbanized areas. Population density of the central coastal area averages 310 persons per square mile, while the southern coastal area averages 762 persons per square mile. Incomes are relatively high, 12 percent above the western average, and the percentage of families below poverty levels is lower.

Only 1 or 2 percent of total employment is engaged in agriculture. The livestock-related economy is minimal. The region is estimated to import more than four times the amount of livestock produced within the region.

Ecological Interrelationships

Except for the California chaparral-bushland--a fairly contiguous community--the woodland-bushland communities occur principally as an ecotone between the desert or grassland biomes and the forest biome. The ecological interrelationships of the woodland-bushlands are closely related to those of the adjacent biomes.

Most of the vegetation is trees or shrubs. Storage of nutrients in the woody plants shows the nutrient cycle. Usable nitrogen is believed to be a limiting factor in productivity.

The woodland-bushland community often occurs on unstable soils and physiographic features. Disturbance of the vegetation often results in extensive erosion and subsequent establishment of desert-type communities, even at higher elevations.

The aquatic ecosystem in the woodland-bushland biome occurs primarily in perennial and intermittent streams generally originating in higher elevations. High intensity storms are common in the biome and result in heavy downstream siltation. Surface disturbance accelerates siltation. Information on the aquatic ecosystem and the microbial ecology of the woodland-bushland is limited and needs further study.

The California chaparral can be considered as an example of a climax vegetation resulting from the continuing influence of fire. The vegetative composition and hot dry summers present a recurring and extreme hazard. Fire removes the shrubby vegetation, the herbaceous vegetation develops rapidly and occupies the site until shrub dominance is reestablished. Removal of the heavily dominant shrub ecosystem by fire or other means can result in disastrous floods and extensive siltation.

Land Uses

Rough and steep topography limit agriculture activities in most areas to livestock grazing. Minor portions of the biome are irrigated.

Big game and upland game birds provide hunting opportunities in most parts of the biome. Areas near cities and towns are used extensively for outdoor recreation; recreation use probably will increase in the future.

Many areas in the biome, such as the California "mother-lode" country, were mined extensively for minerals over a hundred years ago. Most of the mining in that area is now restricted to individual part-time efforts. Underground mining of coal occurs in Utah and Colorado. Open-pit coal mining is increasing. Uranium is mined underground. Areas in Colorado, Utah and New Mexico produce oil and gas and the potential for discovery of additional production areas appears to be relatively high. The western side of the San Joaquin Valley of California also has oil and gas bearing formations and a number of producing wells. Oil shale outcrops in large areas in Colorado, Wyoming and Utah. Experimental work has been done over the past several years in the recovery of petroleum from some of these deposits. The BLM has recently issued leases on some of the oil shale in Colorado. Potentially land uses could be altered drastically on oil shale areas if commercial production occurs.

The biome contains extensive roadless or undeveloped areas with primitive qualities. Some streams in these areas may meet criteria for

wild rivers; a number are now under study. The California oak-chaparral tends to be more developed and has fewer areas with primitive or semi-primitive qualities.

Woodlands in the biome provide a small, but locally important, source of cordwood and fence posts. Pinon-pine nuts are harvested by Indians and others.

Small, isolated ranching or mining towns are scattered throughout the area. Suburban expansion is occurring in the biome in California and in the Salt Lake City area.

Hazards

Hazards in the woodland-bushland biome are similar to those in the cold desert. The broad sclerophyll community presents a major fire hazard to suburban developments in California.

Aesthetics

The woodland-bushland visual environment is one that varies greatly. It ranges from a semiarid to a wooded foothills landscape.

Since valley bottoms in the West are also principal travel routes, much of the woodland-bushland type is exposed to view of the traveling public. In some areas, this view is from a considerable distance. In others, it is directly adjacent to the travel route.

Land form of the woodland-bushland communities varies from relatively flat valley bottoms through the low-rolling foothills to deep-cut canyons and high mesas. Most typical of these would be the rolling foothill area.

Texture varies as the density of the stands vary, from a continuous dense canopy to an open, scattered random pattern.

Color varies almost as much as land form and texture. Where there is a fairly continuous canopy, the gray-green of the vegetation is predominant. As the stands thin, color of the soil or rocks becomes dominant.

Lines are evident only where there is an abrupt change in the vegetation type or where there has been some disruption of the vegetation, i.e., roads, powerlines, chaining, etc. Scale is more easily defined and much more obvious in the woodlands than in the grasslands or desert.

Human Interest Values

Geological

Most geological features of interest are similar to those found at similar elevations in the surrounding desert or grassland areas

which have been previously discussed. For example, the woodland-bushlands may cover the tops of high mesas which are an integral part of the dramatically eroded areas on their flanks. In the California foothill woodland areas, there are numerous faults. Large faults, such as the San Andreas fault passing through both prairie and woodlands, exhibit visible displacement.

Archeological

Prehistoric peoples who used the juniper associate and oak woodlands were, for the most part, the same types who inhabited the hot and cold desert. Different activities tended to take place in the woodland-bushland biome such as hunting or gathering of wild nuts and seeds, but one also finds agricultural areas cleared in the juniper areas so there is no clearcut division of usage.

In the broad sclerophyll areas of southern Oregon and California are indications of the same prehistoric peoples as in the California and Palouse prairie grasslands--an Old Cordilleran Tradition base that developed into an Archaic Tradition which continued to current times.

Historical

Historically, the woodland-bushlands were probably among the last areas to be settled because of the difficulty of converting them to agriculture. Heavy brush and the lack of water made the biome less valuable for agriculture, and grazing was the predominant use in most cases. Consequently, most of the historic events that took place in the woodland-bushland tended to be associated with livestock trailing and Indian-wars, rather than settlement oriented.

The broad sclerophyll community in California includes the "mother-lode" country of the 1849 gold rush. The area is replete with old ghost towns, and remains of mining activities such as dredge piles and huge hydraulic cut banks.

Cultural

This biome has similar cultural values to those of the desert. Of more unique significance, brushlands and wooded foothills of the southwestern portion of California lie along the route of the Spanish Roman Catholic missionaries of the 18th century. Many missions have been restored along El Camino Real, while other sites remain as interesting ruins of more historical than cultural or religious significance.

Coniferous Forest Biome

The coniferous forest biome in the western United States consists of two well defined forest communities (Figure II-27).



FIGURE II-27 CONIFEROUS BIOME IN THE WESTERN UNITED STATES.

The montane coniferous forest (and alpine communities) covers the Cascade Mountains in Washington and Oregon, and the Siskiyou Mountains in Oregon, and the inner Coast Range and Sierra Nevada in northern California from woodland transition to timberline. They extend eastward to the woodland types of the Great Basin and across the Rocky Mountains to the grasslands of the Great Plains.

The northwest coastal forest, the most dense coniferous forest type, is a temperate rain forest. It extends along the Pacific Coast from southern Alaska to western Washington, western Oregon and northwestern California. Figures II-28 and 29 illustrate the two coniferous forest types in the West.

The extent of federally owned lands and mineral rights in the coniferous forest biome is relatively high, especially in the montane regions.

Non-Living Components

Topography

The Cascade and Siskiyou Mountains, Coast Range and Sierra Nevada are moderately to steeply sloping with relief from base to peak varying from 1,000 feet to over 3,000 feet. On the Columbia plateau, the topography is moderate to gentle. In the northern Rockies and most of the southern Rockies, the mountains are moderately to steeply sloping with relief in some areas exceeding 3,000 feet.

Soils

Soils in the coniferous forest biome range from the Inceptisols in cold wet climates to the Mollisols in warm dry climates.

Inceptisols and Ultisols generally occur in the higher elevations and in areas receiving considerable precipitation. Ultisols have clay-enriched subsoils, and are acid in nature. Characteristics of the Inceptisols vary greatly. Inceptisols and Ultisols occur in northeastern California, western Oregon and Washington, and from the Canadian border in northern Idaho and northwestern Montana to central Idaho. A few areas of Spodosols are intermingled with the Inceptisols and Ultisols.

Alfisols occur in areas receiving less rainfall than areas in which Ultisols have formed and therefore are more basic in nature than the latter. Alfisols have a clay-enriched subsoil and a gray to brown surface soil. Large areas of Alfisols are located on the east and west sides of the Sacramento Valley in California and on the east front of the Rocky Mountains in Montana, Wyoming and Colorado.

Mollisols are basic soils which are organically rich and dark colored. Mollisols are located in the southern Rocky Mountains in Utah and Arizona.



Figure II-28. The montane coniferous forest



Figure II-29. The northwest coastal coniferous forest

Entisols are young soils lacking distinctive subsoil horizons. They occur on recent deposits of alluvium, on very steep areas having soil creep and on recently stabilized sand dunes. These soils occur in western Colorado, northwestern New Mexico and central Utah.

Aridisols are generally associated with the desert. However, Aridisols support coniferous forests in parts of New Mexico and Arizona.

Minerals

Mining, mineral processing and refining have significantly affected the human environment in and near local communities such as Butte, Anaconda, and East Helena, Montana; Mullan, Kellogg, Wallace and Pocatello, Idaho; Park City and Price, Utah; Aspen, Leadville, Silverton and Climax, Colorado; Lead, South Dakota; Hurley and Questa, New Mexico. Copper, coal, gold, silver, lead, zinc, molybdenum and phosphate are the principal products. In the early history of mining in these and many other unnamed localities, mining was generally carried on by underground methods, whereas today in some of the above localities, mining is being done by open-pit methods. These changes have aggravated waste and tailings disposal problems.

Water

The water resources of the coniferous forests provide for most of the water needs of the western United States. Major rivers and streams flow from the forests into the grassland, desert and woodland-bushland biomes. Most streams of the coniferous forests are perennial, although some may be intermittent in regions where extended dry periods occur. Natural lakes are an important part of the surface water resource of the coniferous forest biome.

Average annual runoff from the coniferous forests ranges from about 5 inches in the southern Rocky Mountains to more than 150 inches in parts of northwest Washington. In the lower coastal mountains of northern California, Oregon and Washington, where precipitation occurs during the winter predominantly as rainfall, most of the runoff occurs from November through March.

The quality of most surface waters in the coniferous forests is good to excellent. Average dissolved-solids content generally is less than 100 ppm. The suspended-sediment concentrations in coniferous forest streams are generally less than 280 ppm.

Climate

Moist Pacific air moving in a west to east path results in extremely high rainfall in mountain ranges along the northwest coast from Washington to California. After the dry season reaches its climax in July and August, the rainy season comes on gradually and reaches its peak

in December (Figure II-30). Average annual precipitation ranges from 30 to 40 inches in the San Francisco area and 60 to 140 inches in the Olympic Mountains of Washington.

Temperatures range from a low of 0 degrees F along the Washington coast to 30 degrees F at San Francisco; high temperatures can reach into the 90's throughout the area. Mean daily temperatures range from 20 degrees F to 35 degrees F in January to 50 degrees F to 70 degrees F during July (Figure II-31).

During the winter, the wind sometimes attains hurricane force along the ocean coast. Northerly winds prevail--in summer months--especially in the daytime. Thunderstorms are infrequent and usually weak along the western part of the area (Figure II-32).

The climate of the montane coniferous forest is directly related to elevation--the higher the elevation, the colder and wetter the climate.

Precipitation at the lower levels generally averages about 20 inches a year. The higher elevation Sierra Nevada receives 50 inches, the Cascades 90 inches and the Rockies 30 inches. Average January Precipitation varies from 8 inches along the Sierras and Cascades to 1 to 3 inches in the Rockies.

Average July precipitation ranges from 1 inch or less along the Sierra Nevada and Cascades to 2 to 3 inches in the Rockies.

Average daily minimum temperatures during January range from 20 degrees F at the lower elevations to 0 degrees F at the higher elevations. Maximum temperatures during July average 85 degrees F at lower elevations to 70 degrees F at higher elevations. The mean daily temperatures average about 10 degrees warmer during January and 10 degrees colder during July (Figure II-31).

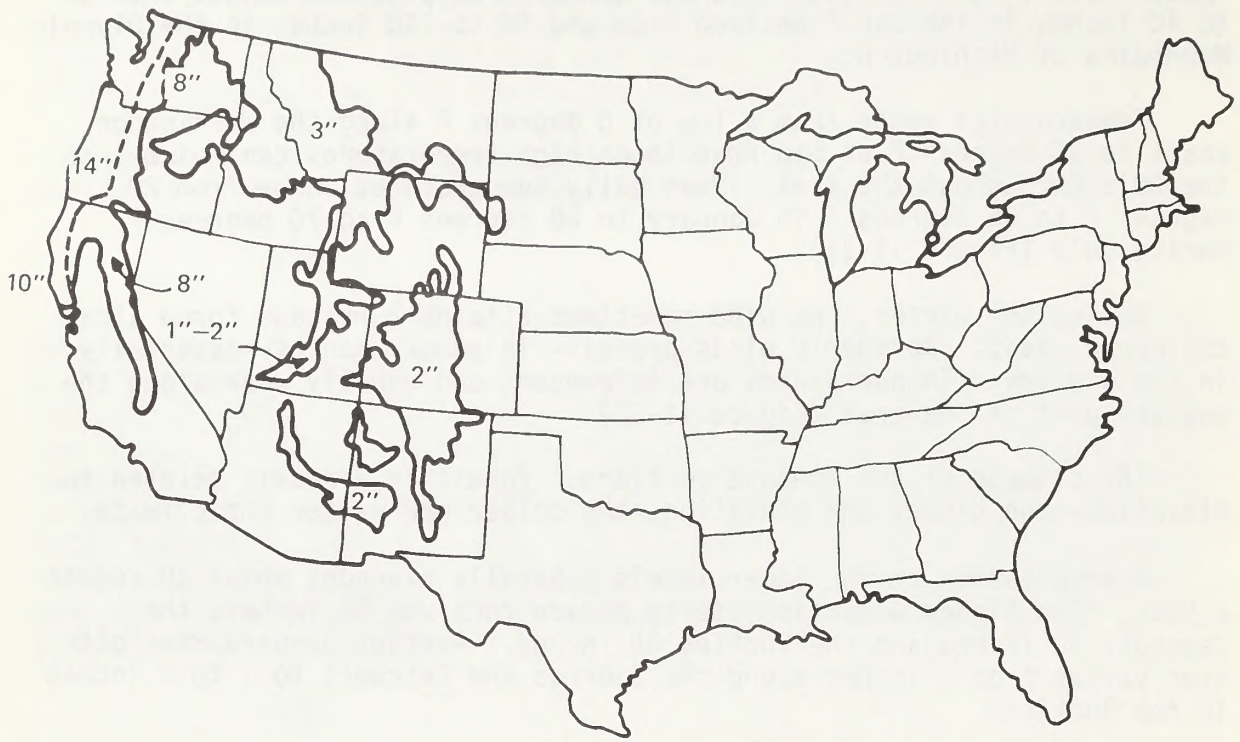
Topography and convective activity--especially during the summer months--affect wind directions and velocities. At the mountain summits, winds generally are from the west and are frequently very strong in the winter and spring.

Thunderstorms occur frequently in the montane coniferous forest. There are an average of 50 to 70 in the forested areas of Colorado and New Mexico each year (Figure II-32).

Living Components

Vegetation

The identifying lifeform in this biome is the needle-leaved coniferous evergreen tree, especially the spruces, firs and pines. The evergreens form a relatively continuous canopy over the forest floor.



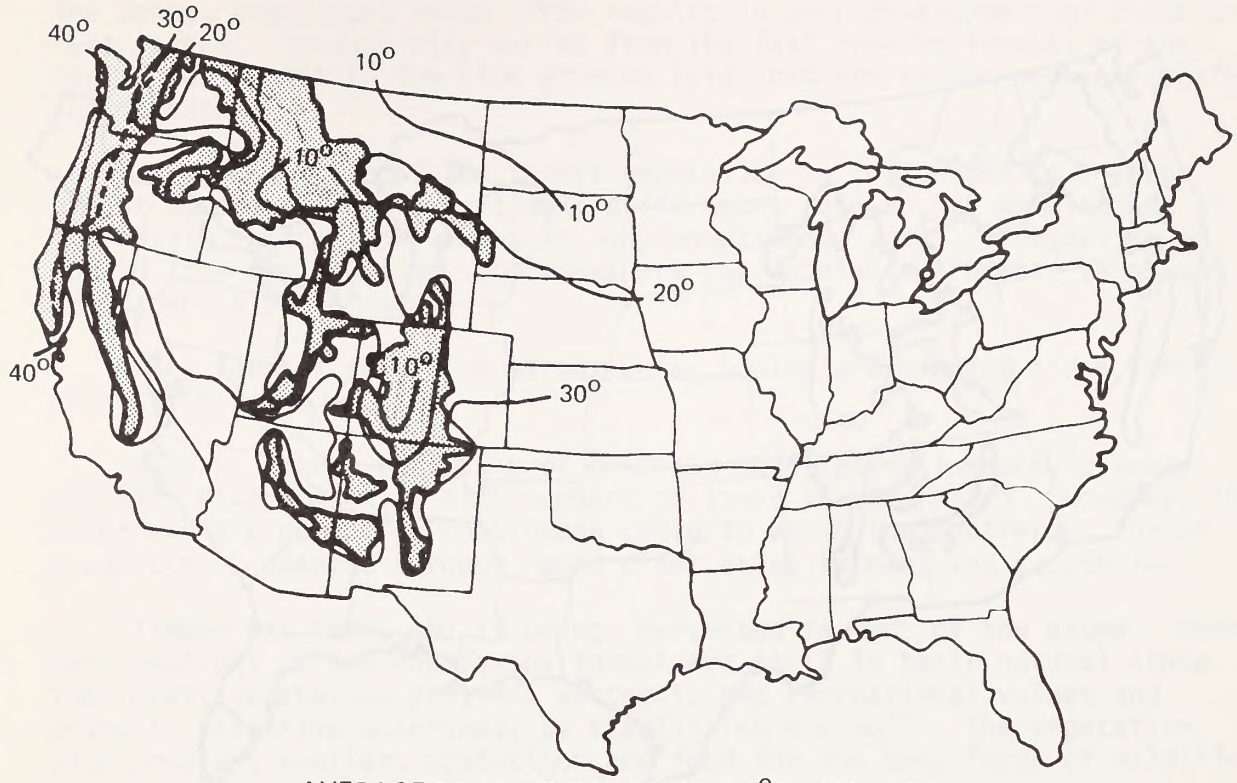
MONTHLY PRECIPITATION (INCHES)–JANUARY



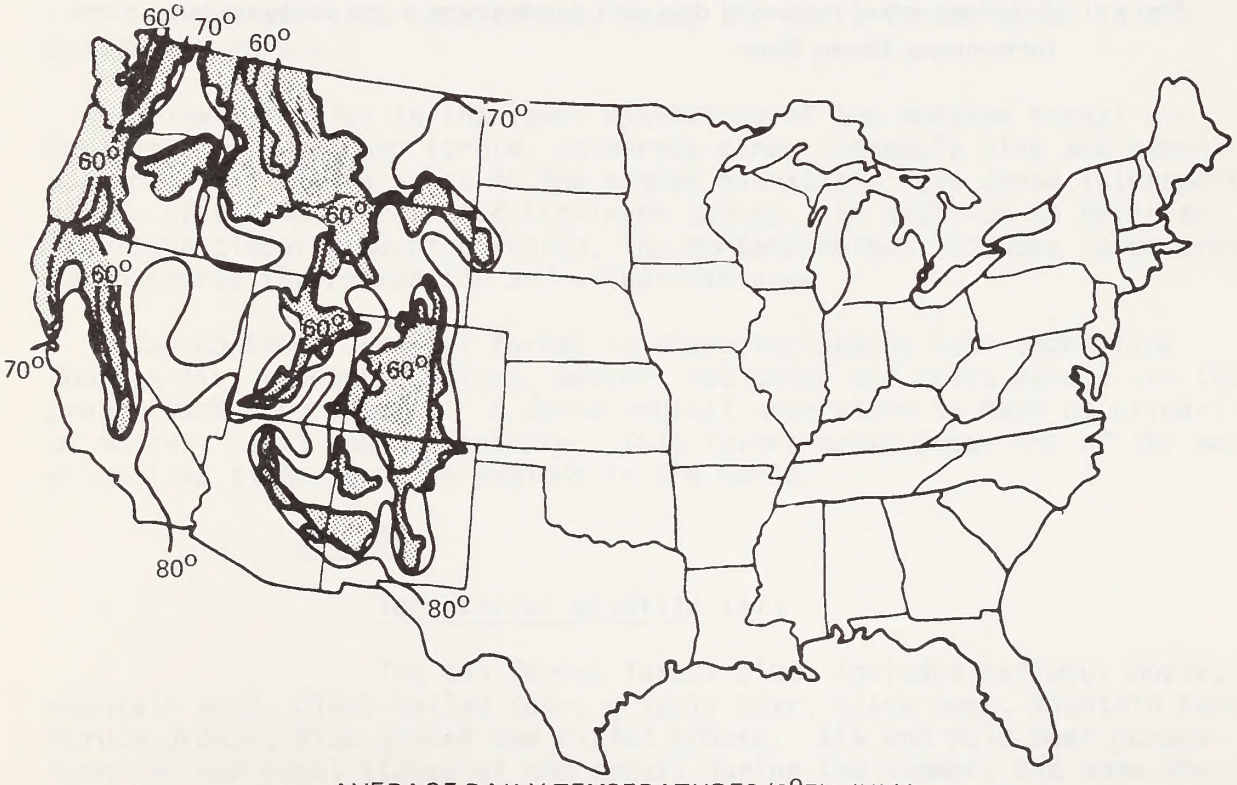
MONTHLY PRECIPITATION (INCHES)–JULY

Figure II-30

Average January and July precipitation in the coniferous forest biome–conterminous United States



AVERAGE DAILY TEMPERATURES (0°F)—JANUARY



AVERAGE DAILY TEMPERATURES (0°F)—JULY

Figure II-31.

Average daily temperatures in the coniferous forest biome in January and July- conterminous United States



Figure II-32 Average annual number of days with thunderstorms in the coniferous forest biome — conterminous United States

The dense, year-round shade often results in poor development of shrub and herb layers. Productivity varies from the fast growing forests of the Pacific Northwest to the slow growing arid portions of the montane coniferous forests.

The composition of the forest vegetation is influenced to a large extent by elevation. Elevational differences lead to the development of four basic vegetational zones in many mountainous areas. Proceeding upward from the lowlands, the zones are the woodlands, forest, subalpine forest and alpine meadows.

Many forests contain numerous water bodies and courses and a variety of aquatic plant species.

Natural forces such as bark beetles, defoliating insects, disease and fire kill unusually high numbers of trees in some years. However, the outbreaks are part of a continuous cycle to which the coniferous forest ecosystem is adapted through rapid plant establishment and succession.

Timber has been, and is being, harvested in much of the biome. However, many sections of the coniferous forest are still in their natural state. The forest vegetation provides aesthetic and recreational values and protects extensive watersheds by stabilizing the soil. The vegetation also provides shelter, protection and food for the many forms of wildlife.

Predominant tree species vary among the basic forest types in the coniferous forest.

Primary species in the lower elevations of the montane forest are Douglas-fir, Engelmann spruce, ponderosa pine, lodgepole pine and aspen. Subalpine and alpine areas in the higher elevations have dense interspersed stands of subalpine firs and Engelmann spruce. In addition to being an important timber producing region, the montane forest includes large areas administered for recreation and wilderness uses.

The northwest coastal forest is characterized by lush vegetation. Douglas-fir, redwood, hemlock, western red cedar and sitka spruce are the predominant tree species. A dense vegetal understory is made up primarily of mosses, salal and salmonberry. This forest constitutes one of the most productive timber growing regions in the world.

Animals

Terrestrial Wildlife (41)

The coniferous forest biome includes caribou, moose, mountain goat, black-tailed deer, grizzly bear, black bear, mountain sheep, spruce grouse, blue grouse and ruffed grouse. Elk and mule deer occupy openings and seral stages of the forest during the summer, and move down to adjacent lower elevation biomes for the winter. Mountain lions and coyotes are also common. Smaller animals of the montane forest include the

porcupine, snowshoe rabbit, long-tailed weasel, striped skunk, flying squirrel, red squirrel, pocket gopher, deer mouse, western jumping mouse and vagrant shrews. Fifty-six species of nesting birds have been recorded in the central Rocky Mountains. To the south, the Kaibab and Aberts squirrel occur. In the Oregon-California portion of the montane forest, mountain quail, band-tail pigeon, Oregon junco, pygmy owl and the California mountain kingsnake are common. A number of destructive insects (spruce budworm, Douglas-fir beetle, mountain june beetle and Jeffrey pine beetle) feed on the trees.

Some of the same species of animals found in the central Rocky Mountains are found also in the northwest coastal forest. Principal mammals are related to Rocky Mountain species. Roosevelt elk and black-tailed deer are characteristic of this forest, as is the smaller mountain beaver. Douglas gray squirrel, coast mole and the band-tailed pigeon are typical residents.

Aquatic Wildlife (41)

The waters in most of the streams and rivers in the montane coniferous forest biome are usually of high quality and low temperatures. Aquatic ecosystems are diverse and complex. They usually contain a fair grade of aquatic food. High elevation streams support trout, whitefish and sculpin. Lower streams support chub, carp, dace, suckers and salmonids. Other common fish in the biome are black bass, sunfish, catfish, pike and minnows.

West Coast streams produce anadromous steelhead and five commercially important species of salmon: the chinook, sockeye, chum, pink and coho. Migratory populations of coastal cutthroat trout are present in many coastal streams from California to Bristol Bay, Alaska. The anadromous fisheries are unique and directly dependent on the forest watershed.

Inland waters of the coniferous biome that do not empty directly into the sea are characterized by high quality, low temperatures and a fair grade of aquatic food.

Threatened or Endangered Wildlife (42)

Following are examples of species threatened or endangered in this biome: Columbia white-tailed deer, American peregrine falcon, greenback cutthroat trout, Kendall Warm Springs dace and Northern Rocky Mountain wolf.

Domestic Livestock

Most domestic livestock grazing in the coniferous forest occurs on the mountain meadows interspersed as small vegetative islands throughout the biome and in open forest stands where forage species grow among scattered trees.

Both cattle and sheep graze in the coniferous forests. Most of the cattle graze in the lower elevations and most of the sheep in the higher elevations. The alpine zone is grazed almost exclusively by sheep. Most livestock grazing occurs between June 15 and October 1. Some horses graze in the biome in connection with recreation activities, such as riding and pack trips. Although horse use is generally minor, it tends to concentrate in popular areas.

Over the years, livestock use declined on the coniferous forests as portions were withdrawn from grazing for watershed protection purposes. This trend could continue as demand for water increases in the West.

Wild Horses and Burros

Some bands of wild horses in the desert biome will range into remote areas of the montane coniferous forest as part of their seasonal habitat. Because of the higher elevations in the coniferous biome, adverse winter climatic conditions restrict year-round use of the biome by wild horses except in those mountain areas where exposed south-facing slopes may afford marginal habitat.

Human

About 20 percent of the western states' population resides in this biome, principally in the Pacific Northwest. Population densities vary, as they do in the grassland biome. Unlike the grassland biome, the rural population has increased since 1960 instead of decreased, with the exception of the Idaho mountainous area. Except for the Pacific Northwest and the California portions of this biome, income levels are lower than average and the percent of families below poverty levels is higher, but differences are not as great as in the grassland biome.

The economies of this biome are heavily dependent on primary type industries. In the Pacific Northwest and mountains of California and Idaho, the timber industry dominates the primary sector with agriculture second. In the mountainous areas of Arizona and Colorado, mining is the major primary industry very closely followed by agriculture. In Montana, Utah and Wyoming, agriculture--principally livestock production--is at least of equal importance with mining and timber. Except for the Pacific Northwest, the percent of employment in agriculture is above the western average, but not nearly as high as in the grassland biome. Income derived from livestock production ranges from a low of two-tenths of 1 percent of total income in the Pacific Northwest, to about 6 percent of total income in the Idaho portion of the biome. The NRL supply 1,110,000 cattle AUM's and 250,000 sheep AUM's which represent about 6 percent of the total livestock feed consumed in the biome.

The Seattle and Portland metropolitan areas are located in a broad valley extending from Puget Sound to central western Oregon. The valley contains the bulk of the intensive agricultural land in the region. Low cost hydro-electric power, abundant water resources and deep water ports have contributed to industrial growth in these urban areas.

Most communities in the montane coniferous forest are also small and serve the logging, ranching or mining which may occur in the area. Recreation expenditures also play a significant role in community support throughout this biome.

Ecological Interrelationships

The western coniferous forest communities are characterized by tree species generally providing dense canopy cover and heavy shade. However, woodland-bushland and grassland communities are interspersed through the biome, especially in the montane coniferous forest.

Precipitation in the coniferous forest ecosystem is high, and generally there is adequate moisture for maximum production of the living components. The forest watershed is a primary source of water flowing through biomes at lower elevations.

The heavy shade throughout the year limits development of understory. Moderate amounts of soil organisms occur. A large volume of nutrients is contained in the biomass of large trees. The turnover time in ratio of biomass to production is slow and over-exploitation could reduce productivity by physical removal of the nutrients from the ecosystem.

Coniferous forest ecosystems generally occur on moderate to steep slopes and often on unstable and erodable soils. Physical disturbance of the forest can increase stream temperatures and sediment concentrations and can adversely affect aquatic ecosystems. Aquatic ecosystems in the biome are complex and diverse. Anadromous fisheries are dependent upon the forest watershed, especially in the northwest coastal forest.

Fire is an important ecological factor in the biome, since it can destroy a stabilized habitat by removing the predominant forest cover and result in creating new biological communities. However, the increased diversity of plant species, higher protein content and edge effect created by fire can improve the habitat for wildlife. The results of fire are especially important in the northwest coastal coniferous forest, an area of high rainfall, but where an annual dry season in July and August may create critical fire hazards. On the other hand, fire is considered by many forest ecologists as necessary to perpetuate the lodgepole pine type in the montane forest. Favorable climatic conditions generally enhance rehabilitation and natural successional recovery in the northwest coastal and montane forest ecosystems.

Land Uses

Forest products, mining, agriculture and tourism are major sectors in the economy of the montane coniferous forest. Lumbering and livestock grazing occur throughout the biome. Ranches or small farms usually are located along streams or river valleys. Mining--not as extensive as lumbering or grazing--provides significant income and employment in some communities in the forest.

Recreation-tourism activities are growing rapidly in the montane coniferous forest. In areas with outstanding recreation attractions, such as the Yellowstone Park area and Aspen, Colorado, tourism is the mainstay of local communities. The montane coniferous forest contains many of the Nation's most important outdoor recreation resources. A substantial acreage of undeveloped land and designated wilderness is located in the forests.

Although most of the northwest coastal forest is rough and mountainous, it is an extremely significant timber-producing area. Lumbering and wood products industries play a dominant role in income and employment throughout the area.

Forested lands, abundant wildlife and fish resources in the northwest coastal forest provide significant recreation opportunities. The Pacific Ocean adds to the recreational diversity. Long periods of rain or fog limit opportunities for outdoor recreation to some extent.

Hazards

As in the other biomes, many plant communities within the coniferous forest contain plants poisonous to livestock. Since livestock graze on the biome mostly during the summer season, the poisonous effect of preferred plant species (such as larkspur) has usually subsided before the grazing season. Also, individual poisonous plants present in a healthy community do not have an adverse effect on the herbivores because of the variety of diet consumed by the animals.

The susceptibility of forests to wildfire creates a hazard to humans, livestock and wildlife during burning periods.

The severe climatic conditions that prevail during the fall and winter season in portions of the montane coniferous forest present extreme safety hazards to the novice sportsman pursuing recreational activities such as snowmobiling and hunting.

Aesthetics

Coniferous forests provide perhaps the most spectacular scenic values of all biomes. Landform varies from rounded foothills of the Cascades to angular peaks of the Rockies, from relatively flat mesas and basins to nearly vertical-walled canyons.

Textures vary from the relatively soft continuous forest canopy of the west slopes of the Cascades to the broken patches of trees among rocks at higher elevations of the montane regions. Colors generally reflect the green of the conifer canopy. However, in the higher elevations as the vegetation becomes more sparse, colors of the exposed rock and soil become apparent.

Lines are probably more obvious in the natural environment of the coniferous forest biome than in any other biome. There are many abrupt changes in vegetation types caused by man or nature. Lines may be evident in the sharp angular surface of exposed rock.

Scale, though easily defined, may become almost overpowering in some areas. Many people are not accustomed to the extreme vertical relief common to this biome. The overall effect varies with the background of the individual observer. To some, mountains are frightening--to others they are a comfortable place to be. The wide variety of forms, textures, colors and lines make the scenic values in the coniferous forest biome interesting. Vastness of scale and distance bring an awesome feeling of isolation to many visitors within this region.

Human Interest Values

Geological

The montane coniferous forest includes glacial features such as moraines, lakes and U-shaped valleys. Erosional features like canyons, pinnacles and mudflows as well as volcanic features such as lava flows, eroded ash beds, exposed plugs, hot springs and geysers are found in this biome.

The northwest coastal coniferous forest is edged with an eroded coastline of natural arches, isolated rock islands, sand dunes and steep cliffs. Higher sections of this forest type contain canyons, volcanic features, caves and evidence of faults.

Archeological

The forests were not generally inhabited by native Americans. These people instead lived along water courses and used the forests for hunting and gathering. The peoples of the deserts and grasslands used the coniferous forests that were within range of their traveling ability.

The northwest coastal coniferous forest was the home of the salmon-fishing oriented Northwest Coastal Cultures. Based on the Old Cordilleran Tradition and the Northwest Coastal Tradition, it quickly evolved to become very distinctive with its great use of wood and elaborate art works. Village sites were along the streams and consisted of either pit or surface houses. Occasional rock shelters and some campsites are found away from the streams.

Historical

The coniferous forest tends to share its history with the nearby grasslands and desert. Use was somewhat similar to prehistoric times when most of the campsites occurred in the valleys and few people lived in the forests.

In the northwest coastal coniferous forest, history revolves primarily around the lumbering industry and mining. Fishing and maritime activities are also an important part of the region's past. Russian and British trading activities in the area and similar later efforts by Americans are important facets of the late 18th and early 19th century history.

Cultural

Most of the montane coniferous forest is too high in elevation for any permanent Indian settlements although some are located in nearby areas. Other ethnic/religious groups from the surrounding grasslands and deserts use the montane coniferous forest.

There are only a few groups of Indians living in the northwest coastal coniferous forest.

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PART III

ENVIRONMENTAL IMPACTS OF THE LIVESTOCK GRAZING MANAGEMENT PROGRAM

Introduction

This part of the statement analyzes impacts of the livestock grazing management program without considering mitigative actions. This provides a benchmark for analysis and a perspective of the potential impacts any one action might cause.

Many of the impacts are similar throughout each of the biomes. Where differences do occur, these are identified. The impact on each major environmental component is discussed separately. Adverse impacts which remain after application of possible mitigative measures are described in Part V.

The impacts are categorized by environmental components and discussion under each component is further broken down into the livestock management actions and the supportive measures of the livestock grazing management program.

Livestock management actions considered are: adjustment of numbers, changing season, frequency and intensity of livestock use, changing class of livestock, deferment of livestock use, rotation of livestock use, rest from livestock use, distribution of livestock and/or removal of livestock.

Supportive measures considered are: fencing, corrals, pipelines, ponds, springs, wells, drinking facilities, storage tanks, catchments, roads and trails, vegetation manipulation, animal control, transportation of livestock and camps. Table I-1 on page I-4 gives a listing of existing and projected supportive measures that are needed to implement the allotment management plan program.

Non-Living Components

Soil

Impacts from Livestock Management Actions

Livestock grazing on NRL may result in soil compaction particularly in areas of concentration. Compaction alters the soil microclimate in terms of less pore space, oxygen and reduction in moisture infiltration. This, in turn, affects soil microflora and microfauna. More obvious surface indicators where compaction occurs are increased water runoff and changes in vegetation composition and ground cover. Animal wastes are deposited on the soil surface, introducing pathogens foreign to the soil. However, such wastes enter into natural nutrient cycling processes and provide soil fertility. On relatively small areas where animals congregate, i.e., near water and under shade, impacts of trampling and solid wastes on soil may be deleterious on these small localized areas.

Within most biomes, many soils display seasonal changes by loosening of soils during the winter frost period and compaction during the summer rainfall period (1). Grazing on these soils tends to hasten compaction, which increases the volume of surface water runoff and its sediment load (2). A study spanning 14 years demonstrated the effect of grazing on shale-derived soils in western Colorado. No grazing produced a reduction in overland flow (runoff) of 30 percent and sediment-load of 45 percent less than grazed watersheds (2). Studies on other soils and locations have indicated that light grazing on certain grass types does not affect surface runoff and sediment load if the grazing is light enough to prevent significant decrease in vegetative cover (3). However, if the cover is decreased, runoff and sediment-load are adversely affected. Small plot studies in the grassland type in Arizona indicate: (a) winter runoff was independent of the amount of perennial grass vegetation and (b) total runoff was unaffected by light grazing, but when overgrazing reduced the amount of perennial grass, there was a marked increase in surface runoff, sediment load increased and duration of the flow decreased resulting in extending the periods of dryness onsite (4). Another small plot study in the coniferous forest biome with fixed amounts of simulated rainfall indicated erosion was more closely related to the amount of vegetative cover than any other site characteristic (5). However, the relation between erosion and cover was strongly influenced by slope gradient: the greater the slope, the greater the susceptibility to erosion.

Tables III-1 and III-2 show the comparison of estimated sediment production between present watershed conditions and watershed conditions when the AMP program is fully implemented.

Management actions, such as reduction in livestock numbers, deferment of use, rotational grazing, rest from grazing and changing animal distribution patterns will minimize soil compaction. During rest, rotation and/or deferment, an opportunity is provided to allow natural forces to restore the soil to a natural state (see Figure III-1). In a grazing system, when all the livestock are placed in one pasture, compaction may increase. However, when the animals are rotated to another pasture, the previously compacted soil is "rested" from trampling and, given time, will return to its natural state.

Management actions will have indirect beneficial impacts on the soil through increased ground cover resulting from improved plant density and plant vigor (assuming that overpopulations of wild herbivores are not present). These changes result in associated decreases in overland water flow, salinity, sediment, production, compaction and, in some cases, a lowering of ground temperature and reduction in evaporation from the soil surface.

In addition, unutilized vegetation in the rested pastures falls to the ground as litter, providing additional soil protection. Eventually this litter is incorporated into the soil as humus which supports soil bacteria, enriching the soil, increasing moisture absorption and retention and reducing runoff and subsequent erosion.

Table III-1

Estimated Area by Sediment Production Classes at Present Watershed Condition (Data derived from Watershed Rating procedures, BLM Manual 7322).

Veg. Type	<0.2 [a]	0.2-0.5	0.5-1.0	1.0-3.0	>3.0	Area in Sq. Mi.
Grass	4,876 [b]	12,574	6,415	1,540	256	25,661
Meadow	136	71	45	0	0	252
Perennial Forb	16	78	13	29	9	145
Sagebrush	12,081	53,817	37,343	5,492	1,098	109,831
Mountain Shrub	617	2,015	1,275	206	0	4,113
Conifer	2,110	1,582	1,213	317	53	5,275
Waste (>2% cover)	234	644	908	702	439	2,927
Pinion-Juniper	1,202	14,427	18,435	5,611	401	40,076
Broadleaf Tree	299	80	59	9	0	447
Creosote	310	4,341	8,373	2,171	310	15,505
Mesquite	23	406	1,063	746	23	2,261
Saltbrush	1,163	9,301	9,301	3,255	233	23,253
Greasewood	619	2,552	3,093	1,392	77	7,733
Winterfat	102	966	558	68	0	1,694
Desert Shrub	1,459	10,209	9,967	2,431	243	24,309
Half Shrub	50	614	551	38	0	1,253
Annuals	859	1,054	319	221	0	2,453
Totals	26,156	114,731	98,931	24,228	3,142	267,188

[a] Extimated sediment production in acre feet per square mile per year.

[b] Expressed as square miles, e.g., 4,876 sq. miles, yielding <0.2 acre feet sediment per square mile per year.

Table III-2

Estimated Area by Sediment Production Class When the Allotment Management Plan Program is Fully Implemented

Veg. Type	< 0.2 [a]	0.2-0.5	0.5-1.0	1.0-3.0	> 3.0	Area in Sq. Mi.
Grass	11,547 [b]	12,317	1,283	514	0	25,661
Meadow	234	18	0	0	0	252
Perennial Forbs	N.E. [c]	N.E.	N.E.	N.E.	N.E.	145
Sagebrush	37,343	63,219	8,786	439	44	109,831
Mountain Shrub	823	3,085	205	0	0	4,113
Conifer	3,482	1,476	301	16	0	5,275
Waste (>2% cover)	29	234	878	1,405	381	2,927
Pinon-Juniper	4,008	25,648	8,416	1,603	401	40,076
Broadleaf Tree	N.E.	N.E.	N.E.	N.E.	N.E.	447
Creosote	155	10,854	4,341	155	0	15,505
Mesquite	1,198	520	543	0	0	2,261
Saltbrush	3,720	15,347	3,488	605	93	23,253
Greasewood	1,315	4,485	1,624	309	0	7,733
Winterfat	271	1,372	51	0	0	1,694
Desert Shrub	3,403	15,558	5,105	243	0	24,309
Half Shrub	326	727	200	0	0	1,253
Annuals	2,036	343	74	0	0	2,453
Totals	69,890	155,203	35,295	5,289	919	267,188

[a] Estimated sediment production expressed as acre feet per square mile per year.

[b] Expressed as square miles.

[c] N.E.-no estimate made because of insufficient sample size.



Figure III-1. Ground cover variation due to grazing of livestock. Rest rotation grazing system left of the fence; continuous seasonal grazing on the right.

When animals are confined in one pasture in rotational grazing systems, they are forced to more uniform distribution throughout the pasture. Animal wastes are, thus, more uniformly distributed. As this pasture is rested from grazing during the rotational sequence, wastes are assimilated into the soil through natural processes.

Impacts from Supportive Measures

Impacts on the soil from one or a combination of the support measures depend on the amount of surface disturbance involved. Right-of-Way clearing and construction vehicle activities cause the major disturbance by construction of fences, corrals, roads or trails, and pipeline and water developments. Disturbance of the natural soil surface in many instances results in a concentration of overland flow within an area. When overland flow is concentrated, rill and/or gully erosion may result. In general, the velocity of water movement due to a reduction of the roughness coefficient will increase within a cleared right-of-way, unless a reduction in slope gradient occurs simultaneously. As a result of water concentration and velocity increase, sediment production tends to increase because of the scouring action on loose material within a right-of-way.

Vegetative manipulation practices may result in either an increase, decrease or no change in overland flow or sediment production, depending on many factors such as treatment utilized, soils, climate, aspect, etc. Treatments such as chaining, railing or cabling, have caused increases, decreases or no changes in overland flow or sediment production. The magnitude of the impact is related to many soil and climatic factors as well as physiographic features such as aspect, slope and elevation, among others. Mechanical treatments utilizing the tree crusher or root plow will virtually eliminate overland flow and sediment production for a period of time.

Chemical treatments in general have less impact on overland flow and/or sediment production than do many mechanical treatments. However, chemicals produce a short term impact of soil contamination from both the chemical itself and some carriers used, such as diesel oil.

The environmental impacts of mechanical and chemical vegetative manipulation practices will be covered in greater detail in other environmental statements which are being prepared. 1/

1/ Mechanical and chemical vegetative manipulation practices are to be covered in the following Environmental Impact Statements: Watershed Programmatic Statement, Pinon-Juniper Chaining Statement and the Chemical Pesticides Statement.

The use of fire may result in an increase in some soil nutrients and a decrease in others. It may also result in nonwettable soils under some conditions. Meteorological factors present during a burn have a significant effect on the magnitude of the environmental impacts resulting from the treatment. A torrential storm or prolonged precipitation on an area denuded by fire may result in significant rill and gully erosion and loss of soil and soil fertility.

In summary, soil compaction may occur on certain soils as a result of livestock grazing causing changes in soil flora and fauna, decreased moisture infiltration, and increased runoff, sedimentation, and salinity of water where soil salts are prevalent. Livestock management actions utilizing rest, rotation, deferment, better distribution, etc., will minimize these impacts. Such management actions will provide greater soil protection by increasing vegetative vigor and ground cover, thereby decreasing overland flow, salinity, sediment production, and evaporation and improving the soil microclimate. Unused vegetation in rested pastures falls to the ground as litter and is incorporated into the soil as humus.

Supportive measures which disturb the vegetation and natural soil surface may result in beneficial or adverse impacts on the soil. Construction activities for pipelines, roads and trails, etc., disturb the soil in localized areas and may initiate erosive processes. Vegetative manipulative practices (mechanical or chemical treatment and fire) may adversely affect soil for a short time but, in the long time period, should result in better vegetative cover for soil protection.

The impact of the livestock grazing management program will substantially improve the ability of the watershed to withstand soil erosion. Predicted soil eorsion condition classes by vegetative type are shown in Appendix II-A-1(a) on page II-A-2. This can be compared with the present situation shown in Appendix II-A-1.

Water

Impacts from Livestock Management Actions

Domestic livestock must have access to water. Even under the management program as proposed, certain adverse impacts will result over a short period of time where livestock have access to streams or bodies of water. However, over a longer time frame, deferment, rotation, rest and other management actions will improve streamside vegetative cover and composition. Grazing systems will aid in restoration of streamside vegetation thus stabilizing streambanks and water temperatures and improving water quality.

During the short period when a pasture is grazed in a rest-rotation grazing system, livestock utilize streamside and aquatic emergent vegetation, temporarily reducing vegetative cover and overhang. This may result in some increased sedimentation and water temperature. Animals

wading into streams or bodies of water disturb favorable pool-riffle relationships. In both streams and reservoirs the water may become clouded and muddy from fine sediments which affect aquatic food organisms and spawning beds of some fish species. Also animal excreta will be deposited into the water. These impacts would be confined to only one pasture at any one point in time since other pastures in the grazing system are being rested at this time.

"The pollution potential from wastes of livestock on pasture may be significant if the topography of the land favors a high rate of runoff into a nearby stream and if grazing patterns are such that waste accumulates chiefly in small areas close to surface waters. Limited data are available on the actual impact of livestock wastes on stream water quality in grassland or pasture. However, it appears that the water pollution potential from animal wastes in grazing pastures and grasslands should be minimal under good range management practices." 2/

Livestock in large concentrations in areas where the ground water table is very shallow could cause ground water pollution. However, on Federal grazing lands the water table is almost always deep, and the livestock are usually not concentrated in large numbers where they can pollute ground water used by humans. Another possible undesirable impact upon the ground water may be the physical exhaustion of the supply in critical areas by withdrawal for watering stock. However, withdrawal for stock watering is far less than natural recharge even in the driest areas. Stock watering alone could not appreciably diminish the available ground water. It could contribute, along with industrial, domestic and irrigation uses, to critical situations.

In many areas, especially in the desert biome and southern temperate grassland area, reduced vegetative competition from grasses due to past overgrazing has contributed to the invasion of many deep-rooted woody species (see Figure III-2). These have a higher demand for soil moisture consumption than do herbaceous plants. This causes greater competition resulting in additional loss of grass plants which allows gullies to develop. When the reduction of ground cover and gully development occurs in areas of underground aquifer recharge it may lower the recharge of that aquifer and thereby affect the ground water. Gullies also drain soil moisture from the areas and add sediment to streams and reservoirs increasing turbidity and decreasing water quality.

2/ Methods for Identifying and Evaluating the Nature and Extent of Nonpoint Sources of Pollutants. U.S. Environmental Protection Agency, Office of Air and Water Programs, Washington, D.C.; U.S. Government Printing Office. EPA - 430/9-73-014. 1973.



Figure III-2. Mesquite invasion in the southern grasslands has drastically reduced the soil moisture available for other plants and, in effect, produced a monotype.

As a result of increased water consumption by deep-rooted woody species and the loss of protective herbaceous cover, many historically known springs and seeps have dried up. In contrast, lack of ground cover resulting from past overgrazing permitted water runoff to fill earthen tanks and reservoirs. However, frequently such runoff contained a high concentration of salts adding to the salinity of streams and reservoirs.

As stated in the soil section, the proposed management actions will result in an increased ground cover which benefits soil moisture and lowers sediment production. Improved ground cover on soils containing high amounts of salts will decrease salinity of downstream bodies of water. This will improve the water quality in both streams and reservoirs. Management actions such as removal of livestock, deferment of use and rotational use, lessen impacts of grazing on stream banks.

It is doubtful if management action alone, including removal of livestock, will change the impact of some of the invading deep-rooted woody species and their effect on soil moisture. However, a combination of various treatment practices with various management actions can minimize the woody species in an area and improve soil moisture relationships, thus stimulating growth of residual vegetation and decreasing erosion hazards.

Management actions resulting in improved vegetative cover and composition, and more litter will (and has in some instances in the present AMP's) restore water flow in previously dry springs and seeps. By the same token, increased herbaceous ground cover has reduced or eliminated runoff in some cases and some ponds and reservoirs have gone dry.

An increase in vegetation through management:

(a) may, in some instances, reduce the overland flow to reservoirs and require the development of new water sources;

(b) may, in some instances, reduce overland flow of water and salinity to irrigation water storage reservoirs; and

(c) may induce some springs (aquifers) to reflow.

Impacts from Supportive Measures

Some support measures affect water quality to a greater extent than others. Any support measure having a soil surface disturbance feature as an integral part may adversely affect water quality of a pond or small stream. In general, such a support measure would not affect a stream with a large flow for more than a short distance. Usually, water quality degradation would occur only on very small perennial or intermittent streams and standing bodies of water. Right-of-way clearings (as shown under Soils) could also result in a short term water quality degradation due to increased sediments.

Mechanical vegetative manipulation practices adjacent to or near the water body or stream may or may not decrease sediments, depending on the type of treatment, and if an increase in overland flow occurs. Studies in Arizona have shown that sediment production did not increase following pinon-juniper manipulation (6,7), while in Utah it was reported that the factors influencing sediment discharge were so variable from one area to another that they could not predict the sediment production following treatment (8).

The impact of chemical vegetative manipulation treatments on water depends on the proximity of the treatment area to the water body. It has been shown that phenoxy chemicals released during a direct overflight of a live stream are detectable for only a short distance downstream and then for a short period of time (9).

Fire as a vegetative manipulation practice can affect water quality if the ash and charred material gets into the water. Again, the distance between the treatment areas and the water body would have a direct correlation to the amount of water quality degradation. Ash content including charred material, if allowed to reach the water body or stream, could act much like fertilizer by increasing eutrophication, algae bloom and lowering water quality for fish by decreasing dissolved oxygen content.

To summarize, when livestock have access to streams or bodies of water they will consume streamside and aquatic vegetation, wade into the water and deposit animal wastes in the water, all of which affect the aquatic environment particularly for fish. However, under the livestock grazing management program, such impacts are minimized by rest, deferment, rotation, etc., and are of short duration. In the long run, streamside and aquatic vegetation will be improved by proper livestock management. Restoration of a more natural vegetative composition and increased ground cover from proper livestock management will decrease the spread of deep-rooted woody species which have a high demand for soil moisture, decrease erosion and sedimentation and salinity of streams and reservoirs. Increased herbaceous ground cover will restore water flow in previously dry springs and will reduce runoff to ponds and reservoirs.

The annual consumptive water use of livestock grazing on NRL is estimated at nearly 5 billion gallons. This will increase to approximately 6 billion gallons or 18,400 acre feet yearly by 1990 as the AMP program is implemented. The additional construction of approximately 25,000 small reservoirs will increase the amount of evapotranspiration.

Table III-3, shows the estimated consumptive water requirements on NRL in seven western states for livestock, wildlife and water impoundments.

Table III-3

Annual Water Requirements in Acre Feet for the States of Colorado, New Mexico, Arizona, Nevada, Idaho, Oregon and Washington for National Resource Lands.[a/]

Use	1972	1980	2000	2020
Wildlife[b/]	433,762	446,091	514,792	536,942
Livestock[c/]	14,099	15,581	18,303	24,703
Impoundments[d/]	92,343	98,648	102,936	104,005

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a/ Provided as preliminary data of the Western U. S. Water Plan. Data for California, Montana, Utah and Wyoming are not available at this time.

b/ Wildlife requirements include marshes for waterfowl, stream flow for fish, as well as consumptive use by wildlife.

c/ Annual consumptive requirement.

d/ Includes evaporation which varies from an average annual rate of 70 inches in New Mexico to 25 inches in northern Idaho.

Air

Impacts from Livestock Management Actions

Any of the management actions resulting in an increase in ground cover, through either increased density or plant canopy cover, will have a beneficial impact on air quality. Air pollution resulting from livestock grazing is from two major sources: (a) from the animal itself (odor) and (b) from dust particulate matter.

The air pollution from animal odor is negligible. Only the management action of livestock removal will have any effect on this type of air pollution. Even if the animals are shipped out, there would probably be no measurable effect on air quality over the entire biome. The air quality in localized areas might be improved.

The second form of air pollution, dust particulate matter, may be affected by livestock removal. The majority of the management actions are designed to provide a more effective ground cover through increased litter, plant density or vigor (see Figure III-3). An associated reduction in exposed soil will result in less dust particulate matter being picked up by the surface winds.

There are areas of fine clays or sands within the grassland and desert biomes which are very susceptible to wind erosion. Spring grazing on portions of these biomes has resulted in near eradication of cool season grasses, forbs and browse plants. Spring deferment will result in an increased ground cover during this windy season on those areas where cool season plants were once a part of the plant community.

The action of rotational grazing may result in increased soil exposures for a short time in a pasture being utilized. Other areas, however, would be rested to renew vigor, for seed production and the establishment of seedlings during the same period. In the south temperate grasslands and hot desert portions of the desert biome, this treatment may result in an increase in dust particulate matter pollution because of a greater probability of drought following the grazing treatment.

Impacts from Supportive Measures

When implementation of a management action requires support measures that disturb the soil surface or vegetative cover, there will be a localized impact on air quality. Soil surface disturbance results in a greater probability of increased dust particulate matter entering the air.

Support measures such as fence construction, pipeline installation, water developments, roads and trails and the transportation of livestock can all result in some degree of surface disturbance. The magnitude of the impact of surface disturbance will vary according to the biome in which it occurs. Clearing rights-of-ways in the hot desert or south temperate grassland will have a much longer effect on the air quality than the same action in the coniferous forest or woodland-bushland biomes.



Figure III-3. Following grazing treatment, surface litter and seedling plants remain, providing soil protection.

Climate to a large degree influences the longevity of this impact, as it regulates the plant growth necessary to stabilize the site.

Roads and trails, because of their permanent nature, will have a longer lasting impact on air quality than other support measures, primarily due to vehicular traffic.

Water development and corrals may cause a concentration of livestock for short periods of time which may lower air quality due to odor and dust on these areas.

Vegetative manipulation projects necessary to support management actions could have an influence on air quality for a short time but, in general, will result in an enhancement of the air quality over a long period of time by improving vegetative cover.

Mechanical treatments may result in an increase of dust particulate matter until the area is revegetated. Some minor amounts of hydrocarbons would be put into the atmosphere from the equipment required to do the job.

Chemical treatment of vegetation will result in introduction of chemicals into the atmosphere. The amount of chemical used and method of application will, to a large degree, determine the magnitude of this impact (see Figure III-4). Even considering aerial spraying which would put the largest amount in the atmosphere, there is no reason to believe the effect on air quality would last more than a few weeks (10).

Manual placement of pelleted or powdered chemicals for vegetal control would cause no adverse impacts on air quality.

Any of the support measures can result in a beneficial impact to air quality if they solve an existing problem. If no specific air quality problems existed prior to the implementation of a management action and the necessary support measures, there would not be a beneficial change in air quality.



Figure III-4. Chemicals are introduced into the atmosphere during a vegetative control treatment.

Living Components

Vegetation

Impacts from Livestock Management Actions

Removal of livestock from specific areas such as critical wildlife habitat, frail soils, recreation sites, etc., may be beneficial to the vegetation. Vegetation will develop under natural processes to its ecological potential except as wild herbivores and insects consume vegetation. If the void left by livestock is filled with game animals without proper management, vegetation may still be adversely affected.

Reduction in numbers will have somewhat similar benefical effects on the vegetation. However, even fewer domestic animals will still congregate in favored locations causing vegetation destruction and soil compaction by trampling. Reduction in numbers would reduce the consumption of vegetation, but would not reduce soil compaction in localized areas.

Changing season of use, i.e., from spring to summer grazing for example, removes grazing pressure during a critical period of vegetation growth. In the spring when growth begins, heavy withdrawal is made of stored carbohydrates in the roots and basal portions of the plant to produce new vegetative shoots. Use of stored carbohydrates continues until sufficient green growth is produced for photosynthesis. As growth develops, the plant manufactures increasing amounts of carbohydrates and relies less on stored carbohydrates. Eventually, carbohydrates produced in excess of current needs are stored again in roots and other plant parts. Grazing in the spring season removes developing photosynthetic tissues and retards manufacture of carbohydrates. Constant replacement of these tissues removed by grazing requires additional withdrawal of stored carbohydrates. If this continues during the spring season, plants are seriously weakened or even destroyed. Since cool-season plants are the first to "green up" in the spring, they generally are relished by livestock that have just completed a winter grazing dry vegetation. Because of continued yearlong use, including spring, in the southern grassland and hot desert biomes, early developing cool-season species have largely been eliminated or greatly reduced in the total vegetative ecosystem. Thus, it would be beneficial to change the season of use, defer grazing in the spring or rest and rotate spring grazing use.

In Utah, grazing on cold desert shrubs and grasses during the summer period has been shown to be detrimental to the vegetation (11). Changing season of use from summer to winter grazing, reduction of numbers, deferment from grazing or rotation of use will be beneficial to this vegetative type.

Reduction in the frequency of use would reduce utilization of the vegetation--particularly highly palatable species--and permit improved growth, production and reproduction of all plants.

Deferment or rotation of grazing use are management actions which delay grazing or rotate grazing animals between pastures. These actions permit normal plant development processes with minimal disruption. The timing and length of deferment and the sequence of rotation among pastures are designed to meet plant growth requirements (see Figures III-5 and III-6). For example, the purpose of spring deferment may be to permit plants to gain vigor and store reserve carbohydrates, produce seed and additional forage, allow seedling establishment, reserve the early green spring vegetation for wildlife and provide additional soil protection from wind in the spring months. Rotation of use among pastures is designed in a sequence which serves the same beneficial effects. For example, plants may be rested in a pasture until seed is mature. Grazing use is then rotated into that pasture to assist in shattering, scattering and planting the seed by trampling and scarifying the soil surface through hoof actions of animals. This pasture is then rested again to permit new seedlings to become established and developed, thus providing additional forage, soil protection and altering the vegetative composition. Deferment and rotation of grazing use are management actions applied to benefit the vegetative resources.

Management actions taken to obtain better distribution of grazing use are beneficial to the vegetative resource as a whole. It will force utilization of vegetation on previously ungrazed areas and reduce grazing pressure on favored vegetation on more accessible sites. Better distribution results in more uniform use throughout the grazing area.

The livestock grazing management program will ameliorate selective grazing of preferred forage species. Confining animals into smaller pasture subdivisions forces better distribution of animals in their search to fulfill their forage requirements. In essence, foraging animals concentrated in a smaller unit will make more uniform use of the entire unit and are forced to utilize plants not otherwise grazed. These less preferred species may be just as nutritious as others but are seldom grazed if animals have free choice. Although selective grazing of the more palatable plants and plant parts will continue, other less palatable plants will share the grazing load as the animal seeks its daily forage requirements. When all plants are utilized more or less uniformly, none has a competitive ecological advantage. Previously, less preferred and ungrazed species had a competitive advantage over grazed species because as they declined, the former would occupy the site.

Impacts from Supportive Measures

Construction of fences to implement a management action would have minimal short term localized effects on vegetation, causing slight disturbance due to equipment operation and construction activities. Some vegetation will be disturbed along the fence line (see Figure III-7).

Construction of corrals, pipelines, drinking facilities, storage tanks, catchments, roads and trails removes vegetation in localized areas.



Figure III-5. Area shows reduced soil protection particularly on stream banks. Photo taken 6/21/61.



Figure III-6. Same area as Figure III-5. Photo taken 9/11/64. Area is under rest rotation grazing system.



Figure III-7. Fence as constructed in the past. Note the removal of vegetation along the fence.

Trenching for pipelines can destroy vegetation in a strip several feet wide for the length of the pipeline. Development of roads and trails destroys vegetation for the length of the trail or road. Dust from these roads and trails and pollutants from vehicles will settle on or be absorbed by vegetation. However, impacts on vegetation of dust and vehicular emissions will be localized and minimal because of infrequent use of many roads and trails.

Vegetation may be manipulated by mechanical or chemical means, or by controlled fire. Fire and some mechanical treatments under proper control can change vegetative composition and improve range productivity for livestock or wildlife. Chemical sprays and mechanical treatments can be conducted in a manner to provide only partial vegetative kill, depending on the treatment necessary for a grazing management action. Reduction of competing brush results in greater soil moisture and light penetration providing an opportunity for suppressed plant species to achieve greater vigor and develop naturally.

Vegetative manipulative measures would be beneficial to the vegetation remaining on the site by removing competition and providing better moisture infiltration.

Success of seeding and planting projects is influenced by weather conditions (rain, wind, etc.). Projects that could be expected to yield favorable forage species may, on occasion, result in an invasion of weeds and undesirable browse species if average weather conditions do not prevail.

Construction and use of sheep camps and line cabins have a detrimental effect on vegetation in localized areas around such structures. Line cabins are used infrequently and effects of human and animal activity near the cabin are short-lived.

Areas adjacent to sheep camps may be denuded of vegetation if salt and water are provided on the site, or if the area is used for veterinary treatment at the camp.

Insect and rodent control will be beneficial to vegetation since such organisms are primary consumers of vegetation. However, some rodents do collect and cache seeds, some of which sprout and develop into new plants. In addition, many of these organisms do play a vital role in the ecosystem in the decomposition of organic material, recycling of nutrients, fertilization of flowers, food chains, energy flow, etc.

In summary, all of the livestock management actions are applied in specific situations to provide the vegetation an opportunity to complete normal life processes and, at the same time, to harvest the annual production of usable forage. In essence, each management action is applied to permit selected plant physiological and ecological functions to proceed with a minimum of disruptions. With rest, deferment, rotation, etc., plants are able to synthesize and store food, produce seed which is scattered and planted by livestock trampling and establish new seedlings of ecologically

adapted species. Over time, these actions will restore vegetative cover and composition to a near normal ecological status.

Supportive measures involving construction of fences, water development, building roads, etc., will have short term localized effects on adjacent vegetation. Mechanical and chemical treatments and controlled fire will mostly eliminate the target species from the treated area but will make the site more desirable for the remaining vegetation. Control of insects and rodents would be beneficial to vegetation but would also disrupt the vital role they play in food chains, decomposition of organic material and recycling of nutrients.

Wildlife

Impacts from Livestock Management Actions

Other than livestock removal, each of the proposed management actions will result in some continued degree of competition with wildlife. Each action will be initiated with the specific objective of improving the vegetative resource and, in the long run, will provide more food and cover for wildlife. Properly applied periods of grazing use will reduce competition between livestock and wildlife (see Figure III-8 and Figure III-9). A change in season of use by livestock can prevent livestock use of browse species important to wintering deer populations or forbs utilized by antelope. Utilization of grass in the spring, when it is most susceptible to grazing damage, reduces vegetative competition with important wildlife browse plants. Changing class of livestock can reduce competition or improve compatibility with wildlife. As an example, where grass species are common, domestic sheep compete more actively for browse species important to deer populations than will cattle. Excessive use of wildlife habitat by cattle and sheep can be reduced by adjustment in livestock numbers. Intentional overgrazing by livestock can be used to change vegetative composition to plant species more favorable to wildlife.

Rotation of use can lead to direct competition with wildlife in use pastures. In these situations, the quality of wildlife habitat will deteriorate on a short term basis. On the other hand, pastures rested from domestic grazing use provide the entire vegetative resource for exclusive use by wildlife. Improved plant vigor and density may be anticipated as the rest-rotation progresses. In the long term, wildlife habitat may improve where grazing systems have been implemented on areas suitable for livestock use (see Figure III-10).

It is known that reservoirs in grazing allotments where a management system has been implemented, compared to unmanaged allotments, produced considerably more shoreline and submergent vegetation resulting in a 350 percent increase in number of broods of migratory waterfowl (12). Also broods from reservoirs in managed areas were larger than those from unmanaged areas. At least part of this success is due to the more luxuriant vegetation growing adjacent to the reservoirs (within 100 yards) resulting from the grazing system and used for nesting habitat.



Figure III-8. Severely grazed cliffrose plants show the result of livestock-wildlife grazing competition. Fall and winter grazing by livestock on big game range frequently forces livestock utilization on browse species to meet their nutritional requirements.



Figure III-9. Cliffrose plant recovering after one year deferment of livestock grazing. This and other management actions are taken to enhance wildlife habitat.



Figure III-10. Shoreline recovery as a result of rest-rotation grazing treatment.

The "key" here is that the grazing system be designed in such a way that this habitat not be grazed too closely (leaving a residual for nesting) and that grazing animals not be allowed into the pasture until the broods are hatched and reach the water to prevent trampling of nests and eggs near the water.

Removal of livestock from an area will eliminate the competition for forage, cover and space between livestock and wildlife. It will allow natural regeneration of wildlife habitat subject only to the grazing impact of wildlife and wild horses and burros. Livestock removal from portions of some grazing allotments may be required to protect critical wildlife habitat in all of the biomes. On those areas where livestock are removed, initial impacts beneficial to wildlife would be increased forage and cover. Stream and pond shorelines would recover and sedimentation and organic pollution caused by livestock would be eliminated. Fish habitat would be improved and water temperatures moderated by the influence of improved vegetative cover along streams and other water bodies. The process of eutrophication would be slowed. The potential for cutting new channels or altering the existing water course would be reduced.

Exclusive use by some forms of wildlife may diminish the initial beneficial impacts of livestock removal on wildlife habitat. Light grazing of important wildlife browse plants by livestock stimulates lateral bud development and increases the production of new and tender shoots for wildlife. When livestock are removed, these plants lose the hedged growth form and vertical growth increases resulting in a loss of forage for wildlife. Some forage plants become rank from nonuse and contain old growth unpalatable to wildlife. Unused grasses and forbs may increase the fire hazard. The potential for extensive loss of wildlife habitat by wildfire could be increased. The immediate effect could be serious, but in the long run wildfires may result in improved wildlife habitat in certain plant communities. Private livestock water developments permitted on NRL would no longer be maintained by the livestock operation. The reduction of available water in such areas would make wildlife habitat less usable.

Impacts from Supportive Measures

Development of water facilities results in improved availability for wildlife. Where this occurs in suitable habitat, distribution and numbers of wildlife could be improved (see Figure III-11). Water development can also result in adverse impacts on wildlife habitat if it increases livestock concentration in wildlife habitat areas. This could result in forcing wildlife out of the area to a less suitable habitat. Some wildlife could not adjust and by natural instinct would remain in the area and perish.

Some kinds of fences, although facilitating establishment of rotation systems, create adverse impacts to some kinds of wildlife. All fences impede natural movements or migrations of indigenous big game animals to a degree.



Figure III-11 Sagegrouse watering at a livestock reservoir. These reservoirs provide important sources of water for wildlife as well as livestock.

Death and injury can occur when big game animals become entangled in fences or are cut by barbed wire. Open wounds from this cause can readily become infected. Pasture and right-of-way fences of woven wire in Wyoming restricted winter migrations of antelope under severe storm conditions and are considered to have caused extensive mortality (13). Improperly designed fences along the highway rights-of-way contributed to the loss of bighorn sheep in Arizona. Wildlife benefits from fences constructed to provide for control and management of livestock will be realized where vegetative conditions improve and the habitat is available to wildlife.

Each individual fence may or may not adversely affect wildlife movements. However, several thousand miles of fencing to implement the livestock grazing management program may, cumulatively, have serious adverse effects on big game movements unless construction standards mitigate adverse impacts. On the other hand, fencing to implement management of livestock grazing will improve vegetative conditions for wildlife food and cover in addition to development of additional water facilities.

Vegetative manipulation can have either adverse or beneficial effects on wildlife habitat. Areas of low wildlife productivity can be rehabilitated or they can become even less productive for wildlife. Old age stands of pinon-juniper can be opened to allow for improved growth of palatable understory plant species. Improved forage production on productive soils can reduce livestock-wildlife competition. Manipulation could result in a severe disruption of the life cycle of certain species, especially ground-nesting species.

Animal control measures impact wildlife in several ways. The normal predator-prey relationship can be changed. Although predators can partially control prey populations, a reduction in predator numbers does not necessarily assure an increase in numbers of prey species where other habitat or physiological factors may control the population. An abundance of predators does not, on the other hand, prevent an increase of cyclic populations of rabbits or rodents. Control measures, such as poisoning and trapping, are not selective and may result in the killing of nontarget species. Executive Order No. 11643 prohibits the use of chemical toxicants which cause secondary poisoning effects in predator control programs on NRL except in emergency situations as provided for the executive order.

Predator control has been effective in aiding the reestablishment of important wildlife species on some areas (25,26,27).

Rodent control practices disrupt the normal food chain and the life processes of the target species. In addition, secondary poisoning may occur to scavengers. However, rodents have been known to girdle wildlife browse plants resulting in their death. Control in such instances would benefit other wildlife.

Generally, road and trail construction is considered to be detrimental to many forms of wildlife including fish. Construction activities can

disrupt life cycles and scatter wildlife out of their normal range. Breeding, nesting and production of offspring are especially susceptible during construction activities. Roads often cause changes in wildlife migration patterns. In some cases, however, access roads for hunters will allow better harvests of big game resulting in a more balanced ecosystem. Roads could also result in overharvesting of game, inducing human congestion and reducing the quality of hunting.

In summary, the livestock grazing program will have both positive and negative effects for wildlife. In general the smaller forms of wildlife, particularly small game species are expected to receive more positive than negative impact from the cumulative effects of the action over time. Increased habitat and food conditions should result in improved small game conditions for population growth over time. Those supportive measures formerly inhibiting improved conditions will be under more intensive and planned control with less corresponding adverse effect than has been the historical case: i.e., predator control, vegetative manipulation, supporting developments, roads and fencing. In addition, positive increases in food, cover, diversified habitat and water should further add to improved conditions for small game making their increase possible and likely.

For large game there will also be a general improvement in browse, forb and grass vegetation, both in distribution throughout an AMP area and in condition and quality available for game food and cover. Water supply will also be improved in many areas. Offsetting this beneficial result to some unknown degree will be increased adverse impacts from more fencing, road and trail development, forage competition on some ranges and increased human contact. On balance it is believed the beneficial effects for large game (antelope, deer, bighorn sheep and mountain goat) will however exceed the potential harrassment and/or losses to be expected from the program. This should occur cumulatively over time despite any offsetting tendencies as ranges are improved for cover, forage condition, reduction in erodibility and as increases in available water supplies occur.

Domestic Animals

Impacts from Livestock Management Actions

The proposed management actions will have a wide variety of impacts on domestic animals. Many times these impacts will be adverse over a short time period, but may become beneficial over a longer time frame. An example of this could occur when one of the proposed management actions (i.e., changing of season, or frequency of use, deferment of grazing or rotation of use) is implemented. In most instances, these actions will result in an increase in animal density per unit area. This in turn, may temporarily lower the nutritive value of the animal's diet thereby causing a drop in animal condition. However, in the long run, if the vegetative response is such that an increase in the primary dietary plants occurs, the nutrient values of the animal's diet will improve and so will the individual's condition. It has been shown that adjusting numbers to or below the productive capacity of an area results in an increase in the animal weight gain. (14).

The implementation of rotational grazing may result in an adverse or beneficial impact on the animal. This would depend on several things, e.g., the stocking rate or range condition prior to the implementation of the rotation system. Some studies have shown an increase in animal gains with a change from season-long, or yearlong use to a rotational scheme (15, 16, 17, 18, 19). Other studies have shown a decrease in animal gains under similar changes (15, 20, 21, 22, 23, 24).

Many of the proposed management actions cause an increase in the movement of livestock from one area to another. Each time the animals are moved, it has an adverse effect on them because an adjustment period is necessary to adapt to a different grazing area. The animals also become excited when handled by man and an adjustment period is required for the excitement level to return to normal. These two items will reduce the gain per day of the animals while they are being moved and through the adjustment period.

Impacts from Supportive Measures

During construction of fences, domestic animals may become disturbed because of human activity and equipment noise. The addition of a fence will force the animal to change his grazing pattern in many cases. However, the main effect of the fence will result from the confinement. The basic reason for fences is to force animals to stay on or off an area. In either case, their free choice of movement is disrupted and often will change their diet. This may temporarily lower the individual animal's condition.

There would also be some beneficial impacts of fences on domestic animals. For instance, the purpose of the fence may be to keep livestock away from hazardous areas such as highways, railroads or poisonous plants. Combinations of fencing and one or more of the other management actions may provide a stimulus to the vegetation so that quality of the animal diet is raised. This would result in an improvement in the animal's condition.

Water development has a beneficial impact on domestic animals. Domestic animals spend a certain amount of time drinking and going to or from water. Additional water developments reduce this travel time. In the hotter climates, loafing time at water seems to be related to the distances the animal travels.

Roads and trails can have an adverse impact on domestic animals. They can present physical and health hazards to the animals. The physical hazard is the danger of being struck by a vehicle and being lamed or killed. The health hazard would be from dust and from the vegetation covered by dust adjacent to nonsurfaced roads. Respiratory disorders can occur if the animal is exposed to excessive dust.

When livestock on roads or trails are approached by humans or vehicles they often become frightened and run for some distance. This results in anxiety and loss of weight temporarily. It can also separate cows from calves, lambs from ewes and disrupt distribution patterns.

Roads and trails can have a beneficial impact on livestock by opening up areas to grazing that before were inaccessible or very difficult to reach.

Mechanical vegetative practices may have a short term adverse impact on domestic animals. Many mechanical treatments tend to loosen the soil to some depth. This can make the terrain difficult for the animal to travel until the soil has settled to approximately its original firmness. Practices such as chaining leaves debris which affects the mobility of the animal in traversing the treatment area.

Chemical treatment such as sagebrush spraying would have no impact on domestic animals since BLM's policy is that all domestic animals have to be removed from a chemical treatment area for two consecutive growing seasons.

Trailing of domestic animals is believed to have an adverse impact on the animal. Sheep, especially, can develop sore hooves. Many animals either lose weight or the daily weight gain virtually stops during trailing. Dust from trailing affects the respiratory process. Weight losses and respiratory problems would apply to trucking also. However, the adverse effect to the animal may not be quite so severe as trailing because less time is usually involved. During trucking, some animals may be injured. Abrupt changes from one vegetative type to another can result in a severe and sometimes fatal change in the physiological processes of the animal.

To summarize, management actions requiring periodic movement of livestock and changes in diet as animals are rotated to fresh feed, may cause temporary weight losses and excitement. However, over a longer time period, improved vegetative conditions will provide more forage and improved nutrition.

Additional fences to implement a management action will confine livestock to an area or prohibit their use of other areas such as frail soils, critical wildlife habitat, recreation sites, etc. However, use of fences to control animal use and provide rotation among pastures is important to improving vegetative quantity and quality. Additional water development is beneficial to livestock and permits better distribution. New roads and trails open previously inaccessible areas to grazing but provide a hazard from vehicular impact and respiratory disorders from dust. Mechanical and chemical treatment may have short term adverse effects on livestock but will result ultimately in more and better quality forage. Trailing and trucking of livestock may result in occasional injury, weight loss and respiratory disorders.

Wild Horses and Burros

Impacts from Livestock Management Actions

Livestock grazing management actions imposed where wild free-roaming horses and burros are on NRL will be beneficial to horses and burros. In areas where wild horses or burros are present, such actions as removal of livestock, adjusting numbers, season and frequency of use and deferment and rotation of grazing use will have the effect of providing more forage for wild horses and burros. The success of the management action will also be affected by the management of wild horses and burros. In instances where cattle and wild horses or burros graze the same area, some competition for forage, water and space exists.

Impacts from Supportive Measures

Fencing as a supportive measure to implement a grazing management action adversely affects the free-roaming nature of wild horses and burros.

Fencing would confine the horses and burros, disrupting their normal movements and migration patterns. Frightened animals may attempt to run through a fence or jump over it, resulting in serious cuts or broken bones. However, fencing to control livestock grazing will result in more forage available for all grazing animals, including wild horses and burros.

Development of water (ponds, springs, wells, pipelines, etc.) would be beneficial in providing more dispersement of water for wild horses and burros.

Construction and use of roads and trails will frighten wild horses and burros if the activity is occurring in areas inhabited by horses and burros. In some remote areas, however, some roads and trails would provide a form of access in which the public could observe these wild horses and burros, provided conditions were favorable. In most instances, additional roads and trails would only force the animals into more remote areas and the opportunity for public observation would continue to be a matter of chance.

Vegetative manipulation practices provide more and better quality forage for horses and burros to a limited extent. Downed woody vegetation, such as pinon-juniper, may impede the free-roaming nature of horses and burros. Fire as a vegetative manipulative measure in their habitat destroys the vegetation for a short time and may completely eliminate some species preferred by horses and burros.

The extent of predation on wild horses and burros is unknown. Generally, the population of these animals is considered to have increased in numbers without implementation of specific predator control programs for their benefit.

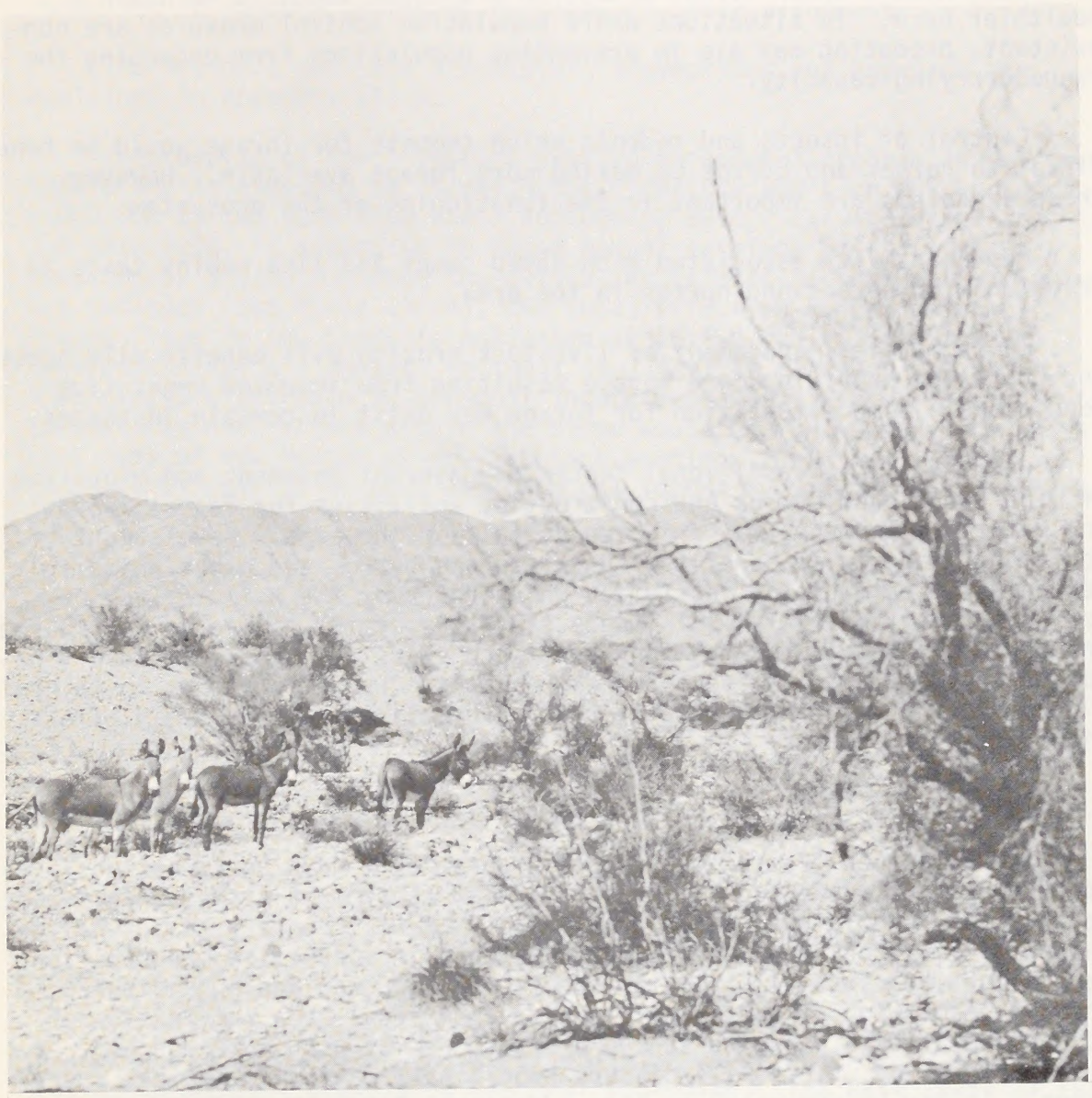


Figure III-12. Wild burros on NRL.

Elimination of predators which prey on sick, maimed, diseased and weakened wild horses and burros could be an adverse impact. The removal of these animals under normal predation processes tends to maintain a healthier herd. In situations where population control measures are non-existent, predation may aid in preventing populations from exceeding the range carrying capacity.

Control of insects and rodents which compete for forage would be beneficial to horses and burros by making more forage available. However, these organisms are important in the functioning of the ecosystem.

Human activity associated with sheep camps and line cabins tends to frighten wild horses and burros in the area.

To summarize, management of livestock grazing will benefit wild horses and burros by providing more forage resulting from improved vegetative conditions. Some competition for forage may exist in certain instances.

Construction of additional fences may disrupt movement and migration of wild horses and burros and construction activities for fences, roads and water developments may frighten animals in the area. Development of additional water will benefit wild horses and burros and other animals. Mechanical treatments of vegetation which roughens the soil surface or leaves vegetative debris will impede the free-roaming nature of wild horses and burros. However, in the long run, such practices should improve vegetative quantity and quality for these animals. Predation tends to maintain a healthier herd so that predator control practices may adversely affect wild horses and burros.

Humans

The livestock grazing management program will have an impact on livestock operators subjected to the intensified management system. This means most operators holding grazing privileges. It will require an intensification of livestock management and investment in supportive measures in many situations that will require additional manpower and expenditures. The implementation of AMP's will involve individual or a combination of actions related to changing season or frequency of use, deferred or rotation grazing. This will disrupt traditional ways of livestock operations. It may be necessary to hire additional labor, buy additional equipment, acquire additional private land forage or forego other endeavors. The operator may be required to move livestock regularly and to construct or maintain range improvements as a condition of the grazing authorization. This involvement is a normal commitment practiced by many ranchers on existing AMP's and to a lesser extent on some other livestock grazing allotments.

The livestock grazing management program will have a favorable impact on the livestock operator from the standpoint of realizing increased productivity through better forage, better control of animals and economic

stability. The exception would be to those operators where removal or reduction in numbers occurs on portions of their allotment.

The economic analysis procedures, assumptions and approach are explained in Appendix III-A.

The results of the livestock grazing management program in the grassland biome is expected to increase the livestock AUM's on NRL by about 1,000,000 by the year 2000 and 1,900,000 by 2010. The increased feed in the year 2000, is estimated to raise annual earnings of the livestock industry by $4,300,000 when the multiplier effects in regional economies are included (see Table III-4), the total effect on annual personal income flows in the biome is estimated at $6,400,000. These figures represent about a 1 percent increase in livestock earnings and an imperceptible increase in personal income from 1970 levels. Probably the largest regional effect within the biome would be in the southern grassland area of New Mexico where livestock earnings could be expected to increase by over 10 percent and personal income by 0.7 percent by the year 2010.

The result of the livestock grazing management program in the regions of the desert biome is expected to increase the AUM's on NRL by about 2,100,000 by the year 2000 and 3,300,000 by 2010, to a total of 11,400,000. The increased feed in the year 2000 is estimated to raise annual earnings in the livestock industry by $4,150,000. When the multiplier effects in the regional economies are included (see Table III-4), the total effect on annual personal income flows in the biome is estimated at $12,000,000. These figures represent a 2 percent increase in livestock earnings and less than one-tenth of one percent increase in personal income from 1970 levels. Probably the largest regional effect would be in the Great Basin portion of the biome. This region experienced a 21 percent increase in population between 1960 and 1970 although the rural population declined by 2 percent. The income effects would have their major impact in rural areas.

The majority of acreage in the woodland-bushland biome was included in the desert biome as a necessary condition of relating the livestock grazing management program to regional economies. The only areas of this biome which could be separated into economic units were the California coastal areas, south of San Francisco. The livestock sector of these regional economies is relatively small and NRL provides small amounts of livestock feed. Therefore, the livestock grazing management program is expected to have essentially no impact in the California coastal economies.

The result of the livestock grazing management program in the forest biome is expected to increase the AUM's on NRL by about 360,000 to a total of 1,718,000. The increased feed is estimated to raise annual earnings in the livestock industry by only $1,100,000; when multiplier effects in regional economies are included (see Table III-4), the total effect on annual personal income flows in the biome is estimated at $1,800,000.

Table III-4: Estimated Income Effects of the Livestock Grazing Management Program by Biome and Livestock Region

Biome and Livestock Regions	NRL AUMs (1,000s)	Addt'l NRL AUMs (1,000s)		Est. Ann Direct Income Eff. $1,000s		Livestock Industry Income Multiplier d/	Est. Total Ann. Income Effect $1,000s
	1970	2000	2010	2000	2010		2000
Grassland Biome:							
N.W. Prairie	146	47	87	266	493	1.428	380
Calif. Central Valley	42	c/	c/	c/	c/	1.096	c/
Spring Wheat (NE Mont.)	459	154	286	388	721	1.426	553
Montana Great Plain	764	232	434	675	1,262	1.789	1,208
Wyoming Great Plain	386	73	144	177	350	1.512	268
Colorado Great Plain	4	c/	c/	c/	c/	1.722	c/
New Mexico Great Plain	152	40	75	157	294	1.536	241
Southern Grassland	1,446	440	824	2,548	4,772	1.443	3,677
Sub Total a/	3,400	1,000	1,900	4,300	8,000		6,400
Desert Biome b/:							
Snake River	669	169	311	774	1,424	1.562	1,209
Cold Desert (G. Basin)	4,174	1,140	1,500	3,055	4,023	1.537	4,696
Cold Desert (Central)	1,010	265	489	657	1,213	1.447	951
Cold Desert (Wyoming)	1,615	358	657	959	1,761	1.654	1,586
Hot Desert	624	191	352	1,918	3,534	1.931	3,704
Sub Total a/	8,000	2,100	3,300	7,400	12,000		12,100
Woodland-Bushland (Part):							
Calif. Central Coast	22	c/	c/	c/	c/	1.003	c/
Calif. Southern Coast	3	c/	c/	c/	c/	1.001	c/
Sub Total a/	25	c/	c/	c/	c/		c/
Coniferous Forest:							
N.W. Forest	19	c/		c/		1.002	c/
Sierra Range	21	c/		c/		1.630	c/
Ariz./N.M. Mtns.	236	117		264		1.337	364
Colo./N.M. Mtns.	613	110		343		1.749	600
Utah Mtns.	64	c/		c/		1.670	c/
Mont./Wyom. Mtns.	304	86		265		1.699	450
Idaho/Ore. Mtns.	100	33		180		1.595	287
Sub Total a/	1,300	400		1,100			1,800
GRAND TOTAL a/	12,700	3,500	5,200	13,000	21,000		20,000

a/ May not add due to rounding.
b/ Includes approximately 30 million acres of woodland-bushland.
c/ Too small to estimate.
d/ Source: Bureau of Land Management's Economic Activity Analysis Model.

These figures represent about 0.6 percent increase in livestock earnings and an imperceptible increase in total personal income from 1970 levels. Probably the largest regional effect in the forest biome would be in the Arizona-New Mexico mountain region where livestock earnings could be expected to increase over 4 percent and personal income by about 0.2 percent. This region experienced a 15 percent increase in population between 1960 and 1970, lower than the western states' average of 24 percent. However, the rural population increased 13 percent over the same period rather than declining at the western average of 5 percent; 58 percent of the total 1970 population of the region is classified as rural. The estimated personal income effect could quite likely sustain another 2 to 3 percent increase in the rural population over the 1970 levels.

Table III-4 contains a summary of income effects in all biomes as well as the cumulative effect in all western states. The reader is reminded that all income effects are the estimates of the incremental effects of the livestock grazing management program as it reflects change from the situation prevailing in 1970.

In summary, the livestock grazing management program will require increased efforts in management of livestock and land resources and perhaps greater investments in supportive facilities, by the livestock operator authorized to graze NRL. On the other hand, improved vegetative resources and better forage production will provide economic benefits to the individual, community and region. Production of meat will increase to help meet the increasing demand.

Ecological Interrelationships

Impacts from Livestock Management Actions

For the purpose of this statement, land use and hazards were considered as part of the ecological interrelationships.

Removal of livestock from specific areas provides more vigorous productive vegetation for soil protection and permits direct cycling of minerals without passing through the domestic animal. Removal could also be beneficial to campers, rockhounds, vehicle operators and other recreationists where there may otherwise be a conflict. Wildfire may become more prevalent and hazardous to structures, people and wildlife.

Reducing animal numbers will have similar effects to a lesser degree. Either action, removal or reduction, could adversely affect individual ranching operations. Reducing numbers may eliminate serious competition with wildlife, wild horses and burros and recreationists.

The increase of livestock numbers on certain areas may have an adverse impact on recreation land uses (ORV use areas, developed campsites, primitive areas, along trails and in wild and scenic river corridors).

Removal may be necessary from areas identified in the planning system. However, the buildup of fuel as a result of removal could cause more frequent and damaging wildfires.

Changing season of use to accommodate recreationists may cause some hardship to individual livestock operators. Livestock use around a fenced campground would not affect recreation use provided it did not occur during heavy recreation use seasons. If livestock use is changed to coincide with a period of heavy recreation use, its impact could be severe and would be similar to impacts incurred with an increase in animal numbers.

By changing the frequency of use of the land by livestock, impacts would be similar to changing seasons of use. If the frequency of use was lessened, the impact could be beneficial on all areas of recreation use. Animals would not be in recreation areas as often, thereby reducing conflicts. If frequency were increased, though, the amount of adverse impacts could increase. For example, ORV uses could be competing with livestock more frequently throughout the year.

If the livestock use of an area were deferred until after the recreation season, the impact would be beneficial. Although of minor importance, fewer vehicle accidents involving livestock would occur. Recreation users would have less disturbance by grazing animals. Odors and health hazards associated with livestock around campgrounds and other recreation sites would be minimized. The opposite could be true if deferment caused use of the area during the recreation season. With rotation of livestock, depending on when the area is used, the same impacts result.

Increasing livestock numbers could be beneficial to individual livestock operators. However, the increase may necessitate acquiring more private land and raising additional hay or cultivated crops to feed the larger animal numbers during periods when they do not graze NRL.

Deferment, rest and rotation of grazing use results in the long run in more productive livestock and in healthy stands of perennial vegetation. This forms a protective soil mantle and a penetrating spreading root system that effectively protects soil from damage caused by raindrop impacts, intensive rainstorms and wind. Accelerated erosive processes are minimized reducing overland flow, sedimentation and salinity of streams and reservoirs. Vegetative material not consumed falls to the soil surface as litter, adding soil protection and is eventually incorporated into the soil as humus, maintaining soil fertility. Humus supports bacterial life, enriches the soil, increases moisture absorption and retention and reduces runoff and erosion.

Impacts from Supportive Measures

Fence construction can affect soils, vegetation and animals, as has been discussed in other sections. In addition, these may also cause changes in wind movement and snow accumulation, particularly where "tumble" weeds may pile up against a fence and significantly alter the temperature and moisture conditions in the microclimate.

Development of water facilities (pipelines, wells, springs, reservoirs, etc.) provides for better distribution of livestock, additional water sources for wildlife (including birds) and for recreation use. Properly designed water developments with sufficient capacity may be stocked with fish for recreation purposes and, with proper management of grazing, provide desirable habitat for waterfowl production (12). Water developments could also act as a focal point for attraction of wildlife thereby increasing viewing opportunities (see Figure III-13).

Vegetation manipulation by mechanical means involves practices which adversely affect soil by disturbing the soil surface and removing vegetative cover. Runoff and sediments may increase in some cases until new plants occupy the site. Mechanical means such as root plows, which disturb the surface as well as the subsurface, provide better water infiltration as well as elimination of competition. Chaining of vegetation, such as pinon-juniper, which leaves debris scattered over the landscape is aesthetically displeasing and restricts movement of big game and livestock. If the debris is piled and burned, air pollution is increased and watershed cover is destroyed, but nutrient cycling is accelerated. Manipulative practives, particularly brush beating and chaining, leave a mulch on the soil surface. This aids in protection against erosion processes and provides protective cover to small mammals and birds.

Chemical spraying to eliminate poisonous plants or brush benefits grass growth by eliminating competition. Commonly some herbaceous broadleaf forbs (which comprise an important component of wildlife feed) are also destroyed. Spray may drift onto adjacent private lands and damage other crops or shade trees. Residues from the chemical may be washed into water bodies, damaging aquatic vegetation and fish.

Fire has historically been a natural force in the ecosystem resulting in maintaining an ecological balance. Controlled burning has the same effect, e.g., eliminating brush and other woody species and increasing nutrient cycling. However, fire results in air pollution may destroy wildlife habitat and denudes the watershed temporarily. Perennial grass species may not be seriously damaged by fire and will begin immediate recovery if moisture is available.

Chemical compounds contained in pesticides may have immediate and long term impacts. The impact from insect control has been beneficial on vegetation where insecticides have been used to control an invasion of grasshoppers or other insects, but removing the organism from the ecosystem may disrupt food chains. Herbicides have been successfully used to control the invasion of brush species into grasslands. Benefits have been realized from these programs through soil stabilization, improved water quality and forage increases for livestock and wildlife. Some pesticides have disrupted natural food chains and have been detrimental to wildlife.

Development of roads and trails destroys vegetation for the length of the road or trail. Roads and trails can have effects on many animal species of the environment. They may be beneficial to some recreationists and the livestock operator by making remote areas more accessible.



Figure III-13. Livestock reservoir with both cattle and waterfowl use in a rotation grazing system.

Adverse impacts can also occur where livestock are trailed when soils or plant growth conditions are most subject to damage from concentrated trampling and use. Water pollution, erosion and increased sedimentation can occur where trail routes are improperly located.

Predators at times adversely affect livestock operations by killing sheep and cattle. A reduction of predators through control measures is beneficial to livestock and the livestock operator under these circumstances. Past control measures included methods which were nonselective and resulted in the death of nontarget species. The adverse impact from the loss of nontarget species prompted the implementation of more selective control measures on national resource lands directed by Executive Order 11643.3/

Line cabins and sheep camps occur on national resource lands and are a pleasant reminder of the "Old West" to many users.

Trucking and trailing of livestock during seasons of heavy recreation use could be adverse to the recreationist. However, many recreationists enjoy seeing sheep and cattle herds trailing along roads. This trailing could interfere with and be hazardous to vehicular traffic, especially when trailing occurs inside highway rights-of-way.

Obtaining better distribution of grazing use involves such actions as fencing, trailing, herding, developing additional water, placement of salt, etc. Uniform utilization throughout the grazing area relieves grazing pressure near streams and reservoirs and other areas of concentration. A beneficial impact can be obtained by controlling distribution of livestock to prevent large numbers in ORV use areas, campgrounds, along trails, in scenic areas and river corridors. This technique properly applied would lessen conflicts between recreationists and grazing animals.

Construction of fences provides better management and control of livestock. However, the fence will have the adverse impact of disrupting natural movements and migration of wildlife, lessening the impression of unbounded "wide open space," limiting access by recreationists and interfering with ORV use. Fences are a safety hazard during electrical storms. They also have resulted in injury and death to snowmobile and other ORV users.

Construction of wells occasionally involves erecting a tower (windmill) which may be an aesthetic intrusion on the landscape.

3/ E. O. 11643, February 8, 1972. Environmental Safeguards on Activities for Animal Damage Control on Federal Lands.

Construction of roads and trails for livestock grazing management also provides better access for hunting, fishing, recreational sightseers and for fire protection. The short term effect of vegetative manipulation on recreation land use can be adverse. The long term effect is probably beneficial as it provides additional opportunities for hunting or viewing of wildlife for more people.

Aesthetics

Impacts from Livestock Management Actions

Aesthetic values are derived by how people perceive the environment and are regulated by form, shape, color, texture, composition, lines, etc. Actions that produce a visible change in any of these elements of the natural environment can cause pleasant or adverse human reaction dependent on the attitudes and values of the individual. Basic elements of landscape character can be affected in four ways:

1. Vegetation can be removed or changed.

2. The soil can be moved or rearranged.

3. A structure can be placed on the landscape.

4. Water may be introduced or removed.

The degree to which any of these four actions take place determines how great an effect the action has on the natural environment.

Grazing management actions can result in either adverse or beneficial impacts, depending on the action taken. In some situations, additional livestock numbers may be permitted to graze without adverse impacts on aesthetics. If livestock numbers are reduced to carrying capacity and other animals are in balance with the habitat, vegetation will improve and soils will tend to stabilize.

Generally, people are attracted to the tradition of the "Old West" that is so much an integral part of livestock grazing on western rangelands. The aesthetic value of observing livestock on the open range is significant to many viewers.

Impacts from Supportive Measures

Supportive measures related to grazing management may result in a beneficial or adverse impact to the aesthetic values of the landscape. Access roads, fencing, pond development, pipelines and storage tank pads all impact the landscape. Because both vegetation and soil are disturbed, there is a potential for long term impact on all biomes.

The adverse visual impacts of the grazing program are partially offset by some benefits. Sometimes access roads open up an impressive scenic vista. Vegetative manipulation might result in forage production that attracts wildlife which can be viewed by the general public. Development of bodies of water could add to aesthetic values.

The manipulation of vegetation may cause a change in the natural environment that can be seen for great distances. Because of the lack of high vegetation and the low relief profile, it is possible to see considerable distances in the grasslands. This makes any surface disturbance quite obvious over a wide area. The lack of vertical elements in the natural landscape makes any man-made structures inordinately obvious.

Desert landforms, although similar to the grasslands in much of the area, are steeper and higher in many areas. Because of this steeper terrain, many of the operations involving the movement of earth will create a more obvious scar and will be visible for greater distances.

The texture of the vegetation in the cold desert, while similar in many respects to the grasslands, takes much longer to recover to its natural condition. Although the texture differs in the hot desert, recovery involves even longer periods of time. The lines created by roads, trails, fences, vegetative manipulation, pipelines and powerlines will be more visible in the desert for a much longer time (see Figure III-14).

In many areas of the desert the color of the surface of the soil and rocks is the result of long years of weathering and chemical interactions. When this surface color is disturbed it is impossible to restore and it may take hundreds of years to recover naturally.

Most of the impacts in the woodland-bushland communities could be very much the same as those in the desert (see Figure III-15). In some areas the impacts may be more obvious because of the density of the vegetation but may recover somewhat quicker. The density of the vegetation might also reduce the visual impact to some degree by restricting the viewing area.

The steepness of the terrain, along with the high relief profile in the coniferous forest, makes fence lines, pipelines and roads running perpendicular to the slope visible for extremely long distances. Clearing the vegetation also opens the slopes up to an erosion process that can soon strip the shallow soils and remove any chance of recovery of the vegetation. The steep slopes also make larger cuts and fills necessary for the construction of roads and storage tanks.

A landscape cover of grasses, forbs, shrubs and trees is more pleasing than one of bare soils, gullies and a monoculture or sparsity of vegetation. To many individuals, a herd of livestock grazing on healthy vegetation provides a scene of pastoral peacefulness and is a pleasant experience.

In summary, management of livestock grazing, in many instances, will result in an aesthetically more pleasing landscape by providing improved vegetative cover and composition.

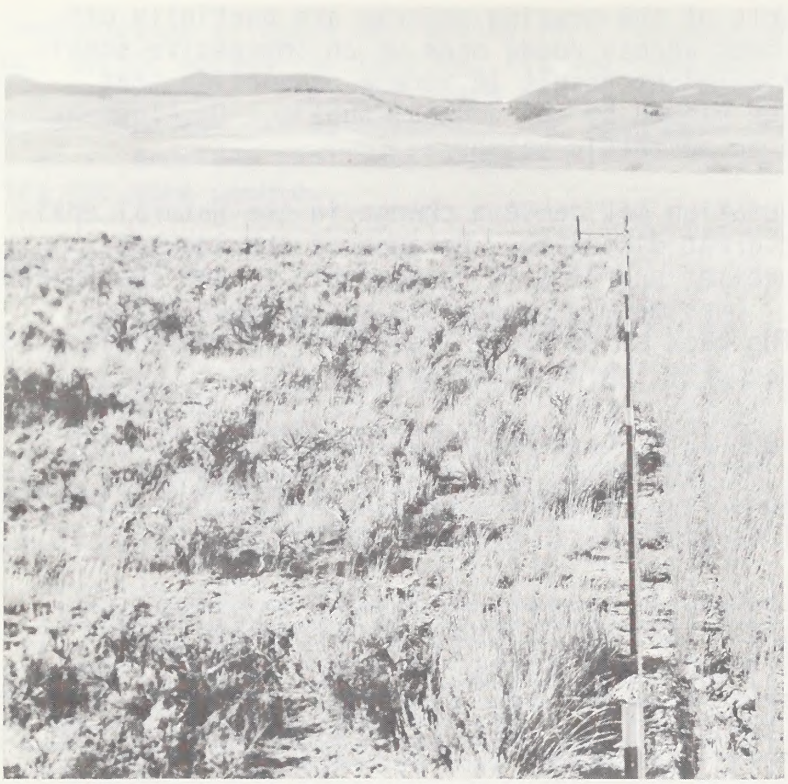


Figure III-14.

Lines caused by vegetative manipulation in the cold desert.



Figure III-15.

Reduced aesthetics in the woodland-bushland biome from vegetative manipulation.

Supportive measures, such as roads, pipelines, fences, etc., can affect a scenic view if not properly designed and located. Roads, however, may make impressive scenic features more accessible and some water developments could add to aesthetic values. Vegetative manipulation practices and soil disturbance can be fairly obvious in certain biomes. Such projects can be designed and located to blend with the natural terrain and may provide a pleasing scenic view if it breaks up stands of sagebrush, pinon-juniper, etc. Man-made structures, changing the texture of vegetation, color of surface soil and lines created by fences, pipelines, vegetation treatment, etc., would all visually impact aesthetic values.

Human Interest Values

Impacts from Livestock Management Actions

All management actions will attempt to minimize impacts on human interest values. Consideration will be given to maintenance and protection of historical, geological and archeological features and values as previously discussed.

Impacts from Supportive Measures

Geological values are susceptible to alteration and destruction as a result of development that can destroy or impair their value as human interest subjects. Activities using explosives, such as road building or well development, in the vicinity of delicate geological features can destroy or impair their interpretive value. Activities involving earth moving can produce similar effects on unique geologic features.

Placing of development structures near geological features of interest tends to detract from their value for viewing and interpretive purposes.

Increased accessibility as a result of access roads and trails for livestock management could contribute to removal or vandalism of the values.

Archeological sites are most valuable to both the scientist and the sightseer when they are undisturbed. Excavation, earth movement or soil compaction in and about an archeological site will reduce or destroy the values the site contains. One impact is providing access which can result in vandalism by human beings who destroy their own heritage by looting prehistoric sites for souvenirs and mementos.

In the past, many roads and trails constructed on Federal lands for livestock grazing have decimated prehistoric remains. This is a potential impact in practically all areas from operations which involve excavation or soil disturbance. Trampling by livestock compacts the soil, which disturbs the stratigraphy and crushes artifacts within the soil. Activities at some distance from archeological sites may trigger erosion which will either destroy the site or cover it with debris. The incongruities of modern things in a prehistoric setting may tend to upset a visitor and subtract from the quality of his visit.

Impact of a livestock grazing management program can be detrimental to historical values if the activities are on or near historical sites and structures. Both the historical research values and the sightseeing recreation value can be destroyed by certain activities. Any type of excavation, earth movement or soil compaction in and about historical places can reduce or destroy the values the site contains. Many historic sites have potential for research using the archeological techniques and these areas should be treated as archeological sites. Heavy equipment can cut up old trails, destroying any feeling of their being historic and damaging any research value they may have.

New roads, trails and other disturbance on or near historic sites and buildings can destroy or damage the historic scene by introducing modern elements foreign to the historic period. This detracts from the understanding and feeling the visitor obtains. Roads will provide better access to archeological and historical sites but may also result in increased vandalism. New roads may also improve fire suppression capability thereby protecting historical values. Construction activities may destroy or impair unknown human interest values.

There are two basic items concerned with impact on cultural values: (a) impact on specific sites and (b) the impact on the life style of a cultural group. Many native and introduced cultures in the country have areas or sites of religious, mythological, historical, symbolic, sentimental or even imagined significance to them and their way of life. These sites and areas should be handled as archeological and historical sites for purposes of impact evaluation and mitigation.

Impact on life styles is difficult to assess for much of it is psychological and the values under impact are judgment values.

Wilderness Values

Impacts from Livestock Management Actions

The degree of impact of livestock grazing on wilderness values will be largely determined by the number of livestock and the season of use in areas possessing wilderness values. BLM administers thousands of acres of NRL that contain wilderness values. Wilderness is defined in the Wilderness Act (PL 88-577) as follows:

> "A wilderness in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrampled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's

work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological or other features of scientific, educational, scenic or historic value."

The Wilderness Act provides for the grazing of livestock in designated wilderness areas where such use occurred prior to 1964. It is not known how much of the NRL possessing wilderness values are subject to livestock grazing but this use does occur over substantial acreages. While the Wilderness Act does not apply to national resource lands it does indicate the desire of Congress relative to similar type land in National Forests. Grazing systems implemented would utilize a minimum of necessary supportive measures thereby having the least impact on the natural conditions of the land which are responsible for its wilderness value.

Impacts from Supportive Measures

All supportive measures, since they are man-made, would have an adverse effect on wilderness values. The existence of permanent roads would in itself negate wilderness status of the land. Fences, water development, vegetation manipulation by artificial means, predator control and the construction of cabins by livestock operators would all decrease wilderness values. Controlled burning, simulating natural occurrence of fire, would have a lesser effect on wilderness values since fire is a natural component of the wilderness ecosystem.

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PART IV

MITIGATING MEASURES

Introduction

The mitigating measures described in this section are available through existing regulations and legislation for application to the livestock grazing management program. The degree to which any of the measures can be implemented is dependent upon public support and resulting organizational capability in terms of funds and manpower.

In discussing mitigating measures by environmental component, duplication occurs, i.e., the measures to reduce impact on soil also reduce impact on vegetation, recreation land use, aesthetics, etc. In order to eliminate duplication, mitigating measures will be discussed for each major item of the livestock grazing management program. Their effect in reducing the impact on each environmental component will be discussed briefly.

Mitigation of Management Actions

The management actions included as part of the livestock grazing management program will be applied where appropriate to achieve management objectives and to eliminate or reduce the adverse impact of grazing on other uses and the environment. The supportive measures to be applied will be based on the management decisions made through the process of the Bureau planning system. None of these measures will be used unless they are needed to accomplish management decisions and benefit the environment or some resource use. They will not be applied in situations which create a significant conflict with other uses or degrade the environment.

Livestock grazing use will be curtailed or eliminated on frail soils (soils which are easily disturbed) and soils where compaction may persist for relatively long periods of time resulting in overland flow and erosion. Such management action would be appropriate on important watershed drainages, especially where salinity is a serious problem. Improved vegetative cover and additional litter and soil humus resulting from rest, deferment, etc., partially reduces compaction and such soils will recover more quickly than where humus is minimal. Increased vegetative cover, litter and humus resulting from proper management can materially reduce erosion.

Improved distribution of livestock over the land area will result in a more uniform distribution of solid and liquid wastes and dissipation of animal odor. Where needed to achieve management objectives, livestock will be removed or excluded from aquatic habitat (streams, ponds, etc.) by fencing. Exclusion of livestock will be made where necessary to eliminate impacts on high use recreation sites, critical wildlife habitat, historical sites, etc. Where possible, the rotation sequence will be timed so that

livestock are not grazing in a recreation area during peak recreation use. Competition with wildlife will be minimized, or in some cases eliminated where corrective livestock management actions are applied. Each management action, in the long run, will provide improved vegetative resources, which in turn may result in more food and cover for wildlife. Livestock can be managed in a fashion to eliminate or reduce grass competition with wildlife browse. Proper livestock management can be used to maintain important browse species in a hedged and vigorous growth form accessible to wildlife. Distributive rotation of livestock use will be used to minimize the adverse impacts of livestock grazing on wilderness values.

Selective grazing of preferred plants and plant parts to the detriment of forage species will be partially mitigated by grazing systems confining the animals to smaller pastures, thus forcing utilization of other less preferred plants.

In some areas of the grassland and desert biomes, the probability of drought is not unusual. The grazing system design in these areas will consider the common occurrence of drought and appropriate livestock management actions will be taken to mitigate adverse impact to the vegetative cover and soil during drought. Management criteria would include flexible herd composition (cows and calves vs. steers), reduced stocking rate and utilization, nonuse in years of marginal forage production and increased use in years of above average forage production.

When cattle are removed from an area, the impact on the livestock operator could be mitigated by providing forage in another area. The impact of increased fire hazard resulting from ungrazed forage can be mitigated by: (a) short term leases at the option of the resource manager and (b) contract or hiring of grazing when needed to remove potentially flammable vegetation.

Mitigation of Supportive Measures

Fences

1. Clearing right-of-way with bulldozers or graders is not permitted under present Bureau policy. This has reduced impact on soils, vegetation, wildlife habitat and aesthetics.

2. Construction of fences across known migration routes of wildlife, wild horses or burros will be prohibited or will adhere to stipulations needed to reduce the impact on animal migration.

3. Fencing specifications will be designed to minimize interference with movement of wild animals.

4. Fences will be designed, located and constructed to minimum BLM specifications necessary to control the respective class of livestock.

5. Except for pole and block, or other specially designed fences, fence posts will be used which blend with the landscape to reduce aesthetic impact unless safety hazards are involved as in ORV use areas.

6. Adequate gates and other passageways through fenced areas will be provided for recreationists, especially ORV users, to reduce impediment to recreation users.

7. Fences will be constructed with lay-down panels where necessary to accommodate wildlife and snowmobile use.

8. Archeological surveys will be conducted along proposed fence lines to avoid impact on these human interest values. Known and potential historical, geological and archeological sites will be avoided.

9. Where wooden posts and stays are used in fence construction, fences will be grounded to reduce hazards from electrical storms and powerlines.

10. Fences will be limited to exterior boundary fences on areas possessing significant wilderness value.

Corrals

Few corrals are constructed on NRL. They will be located and constructed to blend in with the natural landscape to minimize the impact on aesthetics. Use of portable corrals will be encouraged. Corrals will not be constructed in areas with known or suspected archeological values, in areas of high scenic value or in areas of significant wilderness value.

Water Developments

1. All developments will be located and constructed to blend in with the natural environment to reduce the impact on aesthetics.

2. Potentially suitable areas disturbed by construction will be reseeded with a mixture of vegetative species to minimize impact on soil, water quality, vegetation, wildlife habitat and aesthetics.

3. Where feasible, all pipelines will be buried to reduce impact on aesthetics. Methods which least disturb the surface will be utilized and reseeding done with species native to the general area.

4. Archeological investigations will be conducted on all proposed development sites to avoid destroying human interest values.

5. Development of water on or immediately adjacent to significant geological, historical or archeological sites will not be permitted.

6. All waters will be available for wildlife and wild horses and burros. Escape ramps for birds and small wildlife forms should be installed where appropriate. Where water quality permits and a need exists, water developments will also provide for human use.

7. Provision will be made for partial livestock exclosures on ponds or reservoirs to increase wildlife habitat and impede sedimentation and salinization.

8. In areas of significant wilderness value water developments will consist of ponds or catchments only, and construction methods must be compatible with preservation of wilderness values.

Roads and Trails

1. Right-of-way clearing will be kept to a minimum to reduce impact on soil, vegetation, wildlife habitat and aesthetics. Roads and trails will be designed and constructed to reduce adverse environmental impacts and still serve the desired purpose.

2. Adequate drainage will be included during road construction to minimize impact on soil, erosion and water quality.

3. Disturbed areas will be reseeded with a mixture of species native to the general area so as to minimize adverse impacts on vegetation, soil, water quality, wildlife habitat and aesthetics.

4. When no longer needed, roads and trails will be closed and rehabilitated to as near natural conditions as possible.

5. Construction through critical wildlife breeding and nesting areas will be avoided. Construction in areas where noise from vehicles and equipment interferes with lambing, calving, foaling, etc., will be delayed.

6. Roads and trails will be located to conform to the landscape as much as possible, minimizing cuts and fills, with the objective of reducing soil erosion and adverse impacts on water quality and aesthetics.

7. If a serious dust problem exists, road surfaces will be treated where practical to reduce air pollution or safety hazards.

8. Archeological investigations will be conducted along all proposed routes prior to road construction.

9. Where possible, roads and trails will be located away from geographical, historical and archeological values to minimize impact on these human interest values.

10. No permanent roads will be constructed within the exterior boundaries of areas possessing significant wilderness values.

Vegetative Manipulation

1. Archeological investigations will be conducted prior to vegetative manipulation.

2. Provision will be made for design or review of all vegetative manipulative treatment proposals by a multidisciplinary team, including a landscape architect.

3. In scenic areas, manipulation will be kept to a minimum and buffer strips of undisturbed vegetation will be retained. In scenic areas, straight edges and geometric shapes will be avoided.

4. Use of fire and chemicals will be controlled to minimize the impact on vegetation outside of the treatment area. Contracts will include consideration of atmospheric conditions, method and time of application, etc.

5. A buffer strip of vegetation will be retained along all streams to maintain water temperature, protect aquatic habitat and reduce chance of water pollution.

6. In seedings, vegetation species will be provided for wildlife and wild horses and burros, if present.

7. Projects will be designed to leave untreated areas within the total treatment area for wildlife habitat and aesthetic values.

8. Only formulations of herbicides and chemicals approved by the Department of the Interior will be used.

9. Chemicals will be applied only when atmospheric conditions will minimize the possible drift onto croplands, water bodies and other non-target areas.

10. Mechanical treatments will be used only when slope, soil type and method of treatment will result in a minimal or stabilized sediment production.

11. Livestock will be prohibited on the treatment areas until adequate ground cover is established.

12. Watering facilities such as open storage tanks, springs, drinking troughs, etc., will be protected from chemical sprays by covers.

13. Chemical plane flights over water will be restricted to reduce potential for water pollution.

14. Controlled burning will be used only when there is adequate soil moisture at or near the surface so that the surface will remain as cool as possible.

15. Fire will be used only during periods when atmospheric conditions allow adequate mixing and dilution of the smoke.

16. Fire under prescribed conditions will be the only planned means of vegetative manipulation in areas possessing significant wilderness values.

17. Vegetative debris resulting from mechanical treatment which impedes animal movement will be crushed and windrowed or burned.

18. Land treatment practices will be kept to a minimum in areas occupied by wild horses and burros. If treatments are necessary they will be accomplished on relatively small areas in any one year so that the impacts will be localized and not general over the entire area.

19. Mechanical vegetative treatments will be timed so as to minimize the amount of disturbance to wildlife.

20. Some trees will be retained throughout the treatment areas to provide shade and reduce adverse impacts on aesthetics.

Animal-Insect Control

1. Predator and rodent control will be conducted only under strict Federal supervision to avoid any detrimental results such as the killing of nontarget species.

2. Animal control may be prohibited in recreation sites or other areas of concentrated public use.

3. Placement of warning signs will be required in animal control areas.

4. Compliance with Federal and state laws and regulations will be assured in predator, rodent and insect control projects.

5. Use of poisonous substances with secondary poisoning characteristics will be prohibited.

6. Animal control will be permitted only on specific areas where significant damage to livestock is occurring. No control will be undertaken solely for the purpose of keeping animal numbers within arbitrary limits.

7. Control in areas inhabited by endangered or threatened species of wildlife will be prohibited unless the control measures are of no danger to these species.

8. Animal and insect control may be prohibited on areas recognized for their significant wilderness values.

Transportation of Livestock

1. Trucking of livestock will be restricted to recognized roads where such trucking will not create an adverse impact to the resource.

2. Trailing will be allowed only where trucking is not practical.

3. Trailing, when allowed, will be controlled to minimize impact on streams, impoundments, critical wildlife habitat areas, frail soils, vegetation and intensive recreation use areas.

4. Trailing will be prohibited on areas of known archeological and historical values.

PART V

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

Non-Living Components

Soil

1. Increased soil exposure may occur for short periods of time in a pasture being grazed.

2. Soil compaction may occur in grazed pastures, but only temporarily.

3. Certain vegetative manipulation treatments, followed by excessive or high intensity rainfall, amy result in an increase in erosion and sedimentation.

Water

1. Water quality (because of sedimentation) may be temporarily lowered during maintenance of reservoirs, development of springs and construction in flowing streams.

2. A possibility of failure to establish an adequate ground cover by seeding on construction sites exists in areas where soil or moisture conditions are unfavorable. Undesirable species may become established under these conditions.

3. New livestock concentration areas may occur as a result of water development with some loss of water quality at those sites during the grazing treatment.

4. Sediment production may be increased during road construction even though partially mitigated by road grade, side slopes and other design features.

5. Water quality will be affected by the sediment production resulting from road and trail surface runoff.

Air

1. Minor local air pollution may result during reservoir construction due to dust.

2. Dust will reduce local air quality during road construction and vehicular use.

3. Air quality will be affected to some degree from vehicle emissions on NRL roads and trails.

4. Air quality will be locally affected by dust particulate matter while mechanical vegetative manipulation is in progress.

5. Some local air pollution will occur from smoke and particulate matter arising from fires used as a vegetative manipulation technique.

Living Components

Vegetation

1. Vegetation will be destroyed and soil surface disturbed for the width and length of newly constructed roads or trails during the life of the project.

2. Short term contamination of soil, vegetation and air will occur from chemicals used in vegetative manipulation.

3. Temporary reduction in vegetation productivity will occur within a burned area.

4. During vegetative manipulation by chemical spray, the hazard of chemical drift to nontarget areas will be present due to unexpected shifts in wind during application.

5. In most areas where vegetation has been removed there is a possibility that exotic plants may become established; e.g., halogeton in some areas.

Animals

1. Livestock daily gains may be reduced temporarily due to movement from one area to another.

2. Noise from heavy equipment operations may disturb wildlife, wild horses, burros and domestic livestock during road construction. Tranquility in remote areas will be interrupted.

3. Life cycles, nesting, breeding and other natural wildlife phenomena may be interrupted or altered during road construction and subsequent use. Some species will suffer a habitat reduction because of the removal of vegetation from the road surface area for the life of the road.

4. Wildlife, wild horses, wild burros and livestock may be subject to harrassment by vehicular traffic and humans using newly constructed roads and trails on NRL.

5. During mechanical vegetative manipulation, wildlife, wild horses and burros in the area will be temporarily disturbed.

6. During animal and insect control, some killing of nontarget species, although minimized, may still occur.

7. Animals which may add to the public's enjoyment may be temporarily reduced by animal and insect control measures.

8. Food chains of aquatic or terrestrial habitats important to non-target life forms may be adversely affected by some animal and insect control measures.

9. Livestock may incur temporary weight loss during transportation.

10. Livestock may suffer from sore hooves or respiratory disorders from dust associated with trailing.

11. Livestock being transported in vehicles may be subjected to excessive dust, abrupt changes in temperature, shipping fever and injury from being confined in close quarters.

12. Changes in diet that may result from being trailed or transported may result in temporary alteration of physiological processes of livestock.

13. The noise and activity associated with trucking of domestic animals may disturb wildlife, wild horses and wild burros.

Human

1. Livestock operators will be required to increase their investment in time, money and energy.

2. Where removal or reduction in numbers of livestock is the management action required, some individual operators will experience a reduction in personal income and a few may be forced out of business.

3. Implementation of the livestock grazing management program will require additional investment of public and private funds.

Ecological Interrelationships

1. Although minimized, some degree of competition between livestock, wildlife, and wild horses and burros will occur in grazed pastures with all management actions except where livestock is removed.

2. Livestock excreta will be deposited on lands being grazed and in accessible waters.

3. Energy and minerals will be removed from the grazed pastures in the form of livestock products (meat, milk, wool, hides, etc.).

4. With increased vegetative production resulting from management actions, wildfires may become more prevalent. However, in areas where annual grasses or forbs are replaced by perennial grasses, the possibility of serious fires is reduced.

5. Even though all of the latest design features are incorporated into fence construction, some adverse impacts will occur on certain species of wildlife, wild horses or wild burros. Younger animals will be particularly affected.

6. Hazards to ORV's will continue even though fences are well marked. Hazards to snowmobile operators may exist if let-down panels are not lowered prior to heavy snowfalls. Even though fences are grounded, a hazard may still exist from lightning or downed powerlines.

7. Fences will prevent unrestricted movement of ORV's.

8. Injury and death of some species of wildlife, livestock and wild horses or burros can result if the animal becomes entangled in fence wire.

9. Some recreation uses will be temporarily interrupted in vegetation treatment areas.

10. Trucking of livestock may cause a safety hazard in heavy recreation use areas on roadways of common use.

Aesthetics

1. Fences may detract from the aesthetics of the natural scene, even though the design incorporates features and color to harmonize with the surrounding environment.

2. On some occasions, windmills, storage tanks, troughs and pipelines will impact aesthetic values.

Human Interest Values

1. Some geological formations will be altered by construction of roads and trails.

2. Historic and archeological values may become more vulnerable to vandalism by construction of roads and trails.

Wilderness Values

1. Some lessening of wilderness values may occur by the grazing of any livestock in areas possessing significant wilderness value.

PART VI

SHORT TERM USES VERSUS LONG TERM PRODUCTIVITY

The livestock grazing management program involves managing the flow of renewable vegetative resources. Under the terms of the livestock grazing management program and the mitigating measures which can be utilized, the short term use by livestock will not adversely affect the long term productivity of resource values from NRL. The livestock grazing management program will enhance long term productivity and soil protection while still providing for optimum short term benefits consistent with a quality environment.

Short term use can be controlled at levels so as to utilize a flow of resource productivity which would otherwise be lost. As the productive capacity increases over time from management practices, short term use levels can be raised without damaging future capacity, although other impacts may occur as stated in Part III. The need for continued short term use is more fully explored in Appendix III-A under Demand Analysis.

The major objective of the livestock grazing management program is to maintain and improve vegetative resources through management actions and supportive measures. Short term livestock grazing is managed to aid biological processes which will result in improved vegetative conditions and greater stability of soil. Consequently under the livestock grazing management program, improved range conditions may result in an increased sustainable yield of livestock forage, an improved watershed stability, a more productive wildlife habitat and enhancement of aesthetics. Which of the above results will occur is dependent on reaching the objectives of the allotment management plan implemented on a particular grazing allotment.

One possible area where a reduction in long term productivity or benefits could occur is in the field of human interest values. Archeological sites or values could be overlooked in the process of obtaining short term benefits.

Long term values of the site can be severely diminished or lost if disturbed by supportive measures before being thoroughly examined and documented. Historical sites, which at present have not been studied or documented, could be destroyed creating a knowledge gap in the historical chain of man's existence. Unique ecological sites not yet known or examined could be harmed altering the long term benefits which could be derived from them if left undisturbed.

Full implementation of the livestock grazing management program and strict adherence to the goals and objectives established under the planning system will result in minimal loss of long term archeological and historical values. Some areas now possessing wilderness values could have those values severely impaired or eliminated if supportive measures such as fences, water developments, vegetation manipulation or roads are undertaken.

PART VII

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Ecological, historical, geological or archeological values which may be inadvertently destroyed are irretrievable.

The human resources involved in implementing the livestock grazing management program, in a sense, are irreversible and irretrievable. These resources could be applied to other programs on the NRL.

Most areas where supportive measures are applied or constructed can be rehabilitated as facilities are removed. The initial cost of those supportive measures are irretrievable. Wilderness values may be forever lost if the nature of supportive measures resulted in a permanent change to the landscape.

However, all costs of the program--be they labor, capital or noneconomic in nature--are essentially an investment, i.e., costs incurred with the expectation of enhancing the flow of benefits (both monetary and nonmonetary) which over time will exceed the costs. If the expectations and the time horizon prove to be fulfilled, then such costs are in effect retrieved through the benefits. The degree of retrievability, therefore, will depend upon use over time and the protection, maintenance and enhancement of the basic land resource.

PART VIII

ALTERNATIVES TO THE PRESENT PROGRAM

Introduction

This section presents major viable alternatives to the present program varying from complete removal of domestic livestock from NRL to maximum livestock utilization of NRL. Five alternatives are described. The impacts of Alternatives A, B and C are identified in a manner comparable to those of the present program. The impacts of Alternative D are discussed in relation to the present program. Alternative E is the "no action alternative" in accordance with Council on Environmental Quality guidelines.

Alternative A--custodial--management would amount to an administrative bookkeeping program restricted to the issuance of grazing licenses, permits and leases, fee collections and other clerical operations. The management of vegetative resources on national resource lands would be at the discretion of private individuals.

Alternative B--no grazing--prohibit domestic livestock grazing as a multiple use on NRL.

Alternative C--maximize livestock production--implies managing domestic livestock as the dominant use on the estimated 140 million acres of grazable lands of the NRL. This level of management implies nonexploitative, nonexclusive sustained yield use of the NRL, but not full multiple-use consideration through the planning system.

Alternative D--an accelerated livestock grazing management program--would fully implement the allotment management plan program by 1990, approximately 10 years earlier than is expected to be accomplished under the present program.

Alternative E--no change--anticipates no increase in funding for the livestock grazing management program on NRL.

The presentation of Alternatives B and C represents an extreme range of action that could be taken under unusual circumstances, including appropriate legislative mandates. These alternatives have been advanced by documented expressions of interest.

Alternative A - Custodial Management

Description of Alternative Action

The alternative of custodial management for BLM's livestock grazing management program consists of retaining sufficient personnel to issue

long term grazing permits or leases, collect fees and complete necessary administrative functions. Repeal of appropriate legislative authorities and responsibilities listed in Part I (Description of the Program) would be necessary under this alternative.

The existing AMP program would cease to exist as a range management action. Some livestock operators would continue to practice principles of rest-rotation grazing while others would not.

Maintenance of existing range improvements would be entirely up to the permittee or licensee. New improvement construction would be at the individual's discretion. The science of range management would give way to animal management if the individual so desired. The management of vetative resources on national resource lands would be at the discretion of private individuals licensed to graze livestock on their particular allotments.

Consideration of other resources would be minimal on those areas where the land use planning system provides for continued grazing of livestock.

Livestock numbers would tend to be reduced due to decisions occurring within the Bureau planning process. This reduction would probably be around 5 percent over the next 20 years.

On the other hand, short term increases in livestock numbers are likely to occur on grazing allotments to the upper limits of qualified demand until fair market value in grazing fees is reached in 1980 as livestock operators take advantage of increased demands for meat production.

Environmental Impacts of the Alternative Action

1. Little or no improvement in range condition and trend can be expected. Therefore, at least 14 percent of the range will continue to decline. Where proper management occurs, it can be expected that some improvement will continue. Where improper management is the present situation, plant vigor and forage production will remain low and continue to decline in some cases. Plants will be unable to produce seed for reproduction of the species.

2. Competition for forage with other grazing animals will continue on those areas where corrective management action is needed. Selective grazing and reduced vigor of preferred plant species will continue to result in the invasion by less desirable plants with consequent changes in associated fauna. Vegetative cover for soil protection will continue to decline resulting in soil erosion and sedimentation and salinization of water bodies and streams. As a result, water quality will be reduced. Vegetative composition will continue to slowly change to more brush or annuals and poisonous plants on some allotments.

3. Effects of drought on plants in low vigor will continue to be accentuated because growth of root systems is restricted. Forage production, while fluctuating widely in response to annual climatic conditions, will generally decline over time.

4. Where overutilization is continuing and the vegetative resource is steadily deteriorating, stockmen will feed maintenance hay and supplemental rations on the open range or seek alternative grazing lands to remain in business. Feeding maintenance hay and supplemental rations to livestock on open range has an adverse impact on vegetation on specific sites because livestock congregate and trample these areas.

5. The custodial program will not prevent concentrated livestock use of vegetation on certain favored locations. Excessive utilization of forage, soil trampling and disturbance by livestock in favored locations will continue to initiate gully erosion. The potential for topographic change by erosion through the effect of unmanaged livestock will continue to occur at an accelerated pace.

6. Excessive use of vegetation and improper seasons of use will continue on some of the national resource lands. Grazing habits of unmanaged livestock will cause a decline in the most palatable and desired plant species. Root systems will become less well developed. The depth and spread of roots will be restricted, thus limiting the volume of soil from which minerals and moisture can be absorbed. In these instances, roots will become less effective in binding the soil against forces of erosion and plants will become more susceptible to drought. Vegetative composition will continue to change toward plant species most tolerant to grazing pressure and more suitable to arid sites. This includes undesirable and poisonous plant species. Plant litter will be reduced and soil productivity impaired.

7. Deterioration and erosion of soils will continue on NRL where livestock are not properly managed on a system based on the physiological needs of plants and protection of soils. On some of the unmanaged lands accelerated erosion has destroyed a portion of the soil mantle. Destruction of plant cover has reduced the protective cover of herbaceous litter necessary for soil protection. Steep and erodible soil areas grazed by livestock will continue to deteriorate. Erodible stream banks will continue to be trampled.

8. Climate will not generally be affected but microclimates important to plant and animal life will be influenced.

9. Where overgrazing continues, cover for birds and small animals will be reduced. Removal of overhanging vegetative cover from stream banks or shorelines and emergent vegetation from aquatic habitats by livestock grazing will raise the water temperature, increase siltation and destroy important waterfowl nesting habitat. Fish habitat will become less productive where shoreline cover is reduced and water pollution continues or

increases. Forbs and succulents required for wildlife reproduction and survival will be diminished by improper seasons of grazing. Food chains of small organisms will be diminished and ecological balance impaired. Threatened species of wildlife will be jeopardized where important habitats are not protected from overgrazing.

10. A custodial program will adversely affect domestic livestock on those allotments where grazing management is improper and the vegetative resource is depleted. Livestock will not receive adequate forage in some cases and consequently will continue to eat less desirable and poisonous plants. Under these circumstances, animals lose weight, do not breed properly, may abort their offspring and disrupt their physiological functions.

Where continuous yearlong grazing resulting in overutilization is common, particularly in the southern grassland and desert biome, livestock do not attain their full growth potential.

Livestock reproduction and body condition will be impaired under custodial type of grazing management. Required adjustments in livestock numbers, distribution and changes in seasons of use will not occur to the extent necessary. Lands will receive varying intensities of management more as the result of the livestock operator rather than of the resource manager. Overgrazing will continue damage to the ecosystem.

11. Competition of wild horses and burros for forage and water with domestic livestock and indigenous wildlife shall continue to increase. Improper livestock grazing management reduces the land's capacity to provide a natural ecological balance as directed by legislation related to management and protection of wild horses and burros.1/

12. A custodial program is expected to result in a general 5 percent reduction of AUM's in all biomes and livestock regions over a 20-year period. Such reduction is estimated to have very small impact on the personal income levels of the 11 Western States--in total only about $3 million annually. Even at regional levels this reduction could not be expected to reduce personal income levels by as much as one-tenth of 1 percent. Of course, individual income could be significantly affected as the 500,000 AUM reduction becomes reality on specific allotments. Whether the small adverse effects of this alternative on regional economies would contribute to the erosion of rural community economic structures is conjectural. This would be the case only if the income loss was absolute, that is, not offset by an alternative land use which could conceivably more than compensate for

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1/ Wild Horse and Burro Act of 1971: PL 92-195 December 15, 1971

the income loss occurring in the livestock sector. A gradual 5 percent reduction of feed from NRL may also, overall, be easily compensated for by increased productivity on private lands. Therefore, the estimated impact on income may be more in the nature of opportunities foregone than actual losses.

13. On a portion of the land area where proper grazing management has not been applied, nutrient cycling will continue to be disrupted. This will take two forms primarily: (a) excessive removal of plant tissues and minerals from the site by grazing animals, and (b) minerals lost through erosion of soil resulting from improper livestock grazing. Soil organisms, essential to the mineral cycling process (by incorporating organic material into the soil) will be altered to some degree by compaction of the soil. Soil compaction and the removal of plant litter will result in both lowering of water infiltration and increased evaporation from increased solar radiation as a result of more exposed bare ground. Animal wastes in concentration areas deposited or transported into water will disrupt nutrient cycling and affect the fertility of streams and water bodies. In areas where water sources are limited to springs, small or intermittent streams and small ponds, the contamination could be serious. In areas where the water supply is adequate for dilution contamination would be minimal.

On areas where livestock make excessive use of the vegetative resource, leaving little for other life forms, the energy flow and food chain become relatively short, i.e., from primary producer to primary consumer. Other primary consumers (insects, small mammals) and secondary consumers (hawks, coyotes) are at least partially eliminated from the food chain.

A custodial program will affect other land uses where improper grazing is practiced. Aesthetic quality of the landscape will be degraded as a result of vegetative denudation and erosion.

14. Opportunities for other multiple uses such as hunting, fishing and sightseeing could be severely curtailed because of the dominant role the ranchers would have in the management of NRL. As a result, many of the existing access routes across private lands, where the government does not have public rights-of-way to public lands, could be closed and the public lands could take on the appearance of being private.

15. Watering facilities may not remain operable for wildlife use after livestock were removed.

16. In many areas competition between domestic animals and wild animals would increase to the point where the wild animal may perish or be forced to seek new habitats. In other areas this would not happen because of individual operator's interest in the welfare of wild animals.

17. Land treatment projects initiated by the livestock operator could destroy archeological, historical or scenic areas.

18. Toxic and prohibited chemicals could be used with less detection, resulting in the destruction of unique ecological sites or habitats.

19. Reduced budgetary demands by the Bureau to support additional employees, equipment and systems required to manage livestock grazing in the field.

Alternative B - No Grazing

Description of Alternative Action

This alternative would prohibit livestock grazing on national resource lands. Repeal of the Taylor Grazing Act and other appropriate legislative authority and responsibility listed in Part I (Description of the Program) would be necessary.

Environmental Impacts of the Alternative Action

1. Livestock use of vegetation on national resource lands would cease. All adverse impacts of livestock use on soil, air, vegetation, water quality, aquatic habitat and plant density would improve if wildlife and wild horses and burros are held within reasonable limits. The extent that wildlife, wild horses and burros will fill the void of livestock as a component of the ecosystem is not known. The natural nutrient cycle would be restored. Plant succession would be interrupted only by wildfires, wildlife, wild horse and burro use. Sedimentation, salinization and eutrophication of water caused by livestock grazing on NRL would cease.

2. Some restored forage and vegetative cover would be available for use by wildlife, wild horses and wild burros. Ecosystems would not be disturbed for the production of domestic animals.

3. Aquatic and shoreline vegetation would be less disturbed and provide improved habitat for wildlife forms, including fish.

4. Herbicides or other chemical applications to benefit production of livestock forage would terminate. Presently from 50,000 to 80,000 acres of NRL are treated annually for this purpose. Certain mechanical and chemical treatments may still be applied to benefit wildlife habitat and produce forage for wild horses and burros.

5. Animal control practices for protection of livestock would not be required. As a result predators would have an improved opportunity for survival.

6. Wildlife populations would have more vegetation available for use as food and cover. Harvestable surpluses of wildlife will contribute to the enjoyment of some outdoorsmen and would provide additional game meat for human consumption. The mortality of wildlife caused by competition with domestic livestock will be eliminated.

7. The source of domestic stock diseases and parasites transmittable to wildlife would be removed except from those livestock grazing private, state and other lands. Bighorn sheep and deer populations may respond favorably and extend their ranges to historic habitats.

8. Most livestock supportive features including fences, corrals, roads, trails, cattleguards, gates and line cabins could be removed. The impediments to free movement of indigenous wildlife as well as the public would be eliminated in areas of consolidated Federal ownership where access across private lands is not restricted. Access across private lands, however, could become more difficult.

9. Potential damage or loss of historical, geological, archeological, or wilderness values due to livestock grazing programs would be eliminated. Site investigation would not be necessary for either the grazing of livestock or its required support measures.

10. Income reduction by removal or suspension of all livestock grazing on NRL would have significant impacts on the western livestock industry and the regional economies which are dependent on this sector. While some offsetting adjustments could be expected within the industry and economic structures as a result of alternative land uses, there would be a definite depressive economic effect during the period of adjustment and many individuals who are of older age would be permanently disenfranchised of their major source of income. The income effects mentioned here do not reflect any assumptions regarding countervailing adjustments.

Direct effects on livestock industry earnings is estimated at $45 million or 4 percent of the sector's annual earnings in all western states. Earnings in the grassland biome would be reduced about 3 percent, in the forest biome about 2 percent and the greatest impact would be in the desert biome where livestock earnings would decrease 7.6 percent. If multiplier effects on regional economies were included, this alternative would result in a total annual reduction in personal income of about $72 million in the 11 Western States, over half of which would be expected to occur in the desert biome.

Regional effects within biomes vary because of differing economic dependency on the livestock industry and the relative importance of NRL to the industry. The coastal regions of California in the woodland-bushland biome would essentially experience no impact. The largest absolute impact would occur in the Great Basin region of the desert biome where an $11.3

million reduction in livestock earnings would lead to a 0.6 percent reduction in regional personal income. However, the largest relative impact would probably be felt in the southern grassland region of Arizona and New Mexico. Here an $8.4 million reduction in livestock earnings represents 19.2 percent of the total regional earnings of this sector and could be expected to lead to an overall reduction in personal income of 1.4 percent. In this region, the personal income loss is equivalent to the per capita income of 5,000 persons or 5 percent of the rural population.

11. Energy in the form of vegetation that can sustain livestock and produce red meat will be lost to the extent of about 13 million animal unit months annually based on present use. The annual supply of some two million or more feeder calves and over four million feeder lambs to feedlots for fattening and marketing would be lost.

12. Livestock operators dependent on NRL for year-round ranch operation would suffer severely by removal of livestock from NRL. The degree of dependency on NRL to support a year-round ranching operation varies from 12 months in some areas of the Southwest to a few months in the Rocky Mountains. It is doubtful that other grazing lands and forage resources could be obtained to support the livestock removed from NRL and thus, many rural ranching families would be forced out of business. Additional concentrated livestock use on private and other lands to compensate for removal from NRL would seriously deplete these lands and resources.

13. Operators would not contribute to or maintain livestock waters previously available to wildlife. This cost which represents several hundred thousand dollars annually would become the full responsibility of BLM or the State Wildlife Agency.

14. Livestock operations on private lands intermingled with Federal ownership will be severely interrupted. Trespass of livestock on NRL would be inevitable and difficult to control.

15. Removal of livestock from all national resource lands including fragmented parcels located within other ownerships, would require extensive fence construction and maintenance. The impact of extensive fencing could be environmentally unacceptable.

16. Wildfires may become more prevalent as a result of accumulation of fuel. Additional Federal expenditures may be required to control wildfire, prevent trespass by livestock, maintain and develop water for wildlife, wild horses and burros and rehabilitate burned depleted areas.

17. Federal funds may be required to compensate private investment in range improvements now existing on NRL in the same manner as is now provided by existing regulations in the event of classification and disposition.

18. The value of some private lands may decline to the extent that their use for purposes other than ranching may be limited as would usually be the case where private lands represent "in-holdings" within NRL.

19. State and local tax receipts would decline to the extent they are dependent on ranches and ranching operations as a tax base.

20. The use of properly grazed livestock as a tool to provide more rapid improvement of depleted rangelands will be foregone.

21. A relatively efficient use of the renewable vegetative resource of the NRL to produce meat from domestic livestock will be foregone.

Alternative C - Maximize Livestock Production

Description of Alternative Action

This program would provide for livestock grazing as the dominant use on 140 million acres of NRL. It involves the maximum nonexploitative production and utilization of livestock forage. Allotment management plans would be implemented on 133 million acres of NRL. An additional 7 million acres of isolated tracts of NRL would be managed for maximum nonexploitative production and utilization of livestock forage.

Many improvements (water, fencing, seeding, etc.) need to be implemented to maximize production and utilization. All other resources would be subordinated to livestock grazing on these areas. Supportive measures as described under the present program (Part I) would be adopted on suitable areas.

Under this system, the amount of AUM's would be increased approximately 70 percent over the present level of 13 million AUM's as projected in the PLLRC report of 1970.2/

Environmental Impacts of the Alternative Action

1. Major emphasis on maximizing vegetative cover for livestock forage will result in improved watershed conditions but may adversely impact wildlife because of changes in species competition.

2. Vegetative cover would be increased on potentially suitable sites by land treatment practices in the forms of plowing, drilling, fertilizing and seeding grass and other preferred livestock forage species. These may result in extensive exotic monocultures.

2/ United States Public Land Law Review Commission. One Third of the Nation's Land. U. S. Government Printing Office. 1970

3. Critical watershed or wildlife habitats would have livestock completely removed until grazing areas were rehabilitated. This would reduce soil erosion and competition with wildlife.

4. Resource values such as recreation, wildlife, archeological, etc., would be relegated to secondary importance and be permitted only if compatible with livestock grazing.

5. Mechanical and chemical vegetative manipulation projects directed at improving vegetative cover for livestock would tend to stabilize soil and improve water quality. However, pollution of air and water could result from chemical spraying in land treatment projects such as sagebrush spraying. Under present restrictions for chemical and mechanical treatment projects, this pollution would be minimal.

6. Animal control programs (predators, rodents, insects) would be increased to minimize losses of livestock or livestock forage to maximize livestock production.

7. In areas of concentrated application residues of nitrates, phosphates and other chemicals from fertilizer applied to maximize forage will be washed into streams resulting in reduced water quality through eutrophication and other chemical reactions. The results of this action could eliminate desirable fish species and other aquatic wildlife as well as increase public health hazards.

8. The public opportunities to enjoy multiple use activities on NRL would be diminished because of the heavy emphasis on livestock grazing.

9. The quality of wildlife habitat would be lowered in many cases because of the conversion of native plant species to introduced vegetative species for primary use as livestock forage. Important bird nesting areas or winter browse species for big game animals could be eliminated by these conversions.

10. To secure full utilization of livestock forage produced on NRL, many livestock operators would have to purchase additional base lands or make other arrangements for their livestock when not using NRL.

11. The many fences required as a supportive measure would limit movement of wildlife, wild horses and wild burros on NRL.

12. Access to NRL would become more available as new roads and trails are developed for livestock grazing purposes; however, the impact of this alternative on recreation land use would be severe, because the landscape would contain large numbers of livestock and supportive facilities such as fences that would restrict use by recreationists. Increased livestock use would have an adverse effect on developed campsites, ORV use areas, primitive areas and wild and scenic river corridors.

13. The impact on aesthetics to many people would be extreme where large areas of vegetation are altered and extensive vegetative conversions created that detract from the natural setting. The many structures needed to maximize livestock production would intrude on scenic landscapes. The potential for long term adverse impacts is increased with additional and continual vegetative manipulation. Livestock numbers would increase and become a common characteristic of the land. To some people this would be aesthetically pleasing, but to many of the sightseeing public it would be adverse as they would rather view wildlife or natural scenes.

14. Some historical, geological and archeological values would be destroyed by the increase in numbers of grazing animals and construction of supportive measures. The values which were not directly harmed would be subjected to increased human pressure resulting from improved access which would be required under this alternative.

15. Conflicts between wildlife and livestock would increase on some areas since the forage resource would be devoted to livestock production.

16. The better forage conditions and supportive measures would improve livestock condition and production.

17. Livestock numbers would be increased thereby making more offspring available for feedlots or direct slaughter.

18. Increased water developments for livestock would be beneficial to wildlife, wild horses and burros in the area.

19. Economic benefits would accrue to the individual rancher and to the economy as a whole.

20. To the extent that other land uses, such as recreation, are subordinated, there may be some offsetting negative economic impacts.

Unlike the other alternatives and the present program, the income analysis of this alternative includes total impacts rather than just the incremental change from the present situation. This is because alternative "C" represents a nonexploitative economic development alternative; therefore, the total cumulative economic impacts are appropriate. Maximum output is estimated at about a 70 percent increase in AUM's.

The direct effects on livestock industry earnings are estimated at $73 million or about 7 percent of the sector's annual earnings in all western states. Earnings related to NRL use in the grassland biome would also account for about 6 percent of the livestock earnings of the biome; only about 3.5 percent of the livestock earnings of the forest biome would be related to NRL use. The largest absolute and relative impact on incomes could be expected in the desert biome where $35.7 million of earnings represent 10 percent of the total livestock industry earnings. If multiplier effects on regional economies were included, about $58.4 million of personal

income in the desert biome could be associated with maximum livestock grazing on NRL and about $115 million associated with the program over all 11 Western States.

As with other alternatives, regional income effects vary within and between biomes as a result of differing economic dependency on the livestock industry and the relative importance of NRL to the industry. See Appendix III-A for reference to income effects of this alternative as well as others by biome and regions within biomes. The largest regional impact on income would probably occur in the southern grassland regions of Arizona and New Mexico. In this region the $17.8 million of earnings related to NRL grazing at maximum development could be associated with about $25.7 million of personal income (including multiplier effects) or the equivalent of the per capita income of 10.6 thousand persons or 3 percent of the total 1970 population of the region.

Alternative D - Accelerate the Livestock Grazing Management Program

Description of Alternative Action

The accelerated program entails full implementation of the allotment management plan program by 1990 rather than by 2000 as projected under the present program.

The environmental impacts of accelerating the program will be similar to those discussed under Part III for the present program.

Under this alternative it can be expected that the estimated 6,910 AMP's required on the NRL will be fully implemented by 1990. This will result in accomplishing the objectives of increased forage production, improved wildlife habitat, reduced soil erosion and other beneficial impacts to be realized at least 10 years sooner than under the present program. For example, the estimated forage conditions reflected in Table I-3 for the year 2000 would be realized at least by 1990. It can be further assumed that since intensive grazing management will be effected earlier, the accelerated program would prevent certain adverse impacts from occurring at all. This would be particularly true in the abatement of sediment production which tends to increase significantly once site erosion begins and continues unchecked.

Those adverse impacts that cannot be avoided would also accrue proportionately in the accelerated program.

The estimated cost of funding the accelerated program would be $387 million compared with expenditures of $345 million in the present program during the same period. This represents an average annual cost of $24.2 million over the 16-year period of the alternative program versus $21.5 million for the same 16-year period under the present program.

Since projected grazing fee receipts for range improvements would amount to about $181 million and the present base appropriations would represent approximately $164 million over the 16-year period, an additional $42 million would be needed. This could be obtained by increasing the percent of the grazing fee designated for range improvements beginning in 1980 by 15 percent to 65 percent (based on the 1980 schedule), instead of the present 50 percent.

This would result in proportionate decreases to the United States and State treasuries by the 15 percent loss in grazing fee receipts.

Table VIII-1 shows the projected costs and potential source of funds for accelerating the grazing program.

Table VIII-1

Estimated Cost and Potential Source of Funds Required to Implement an Accelerated Livestock Grazing Management Program

Year	Cost of Program (million)	Source of Funds		
		Grazing Fees (million) [a/]	MLR Appropriations (million)	Total (million)
1975	$15.4	6.7	8.7	15.4
76	16.6	7.6	9.0	16.6
77	17.6	8.6	9.0	17.6
78	18.4	9.4	9.0	18.4
79	19.5	10.5	9.0	19.5
1980	21.2	12.2	9.0	21.2
81	27.8	16.8	11.0	27.8
82	27.8	16.8	11.0	27.8
83	27.8	16.8	11.0	27.8
84	27.8	16.8	11.0	27.8
1985	27.8	16.8	11.0	27.8
86	27.8	16.8	11.0	27.8
87	27.8	16.8	11.0	27.8
88	27.8	16.8	11.0	27.8
89	27.8	16.8	11.0	27.8
1990	27.8	16.8	11.0	27.8
TOTAL	386.7	223.0	163.7	386.7

[a/] Beginning in 1980 grazing fee receipts for the range improvement fund would increase approximately 15 percent. These funds would be available beginning in 1981.

Alternative E - No Change in the Present Level of Funding for the Livestock Grazing Management Program.

Description of the Alternative Action

Under this alternative the present funding level for the livestock grazing management program will remain unchanged in the future. Congress would continue to appropriate the same amount of public funds for livestock grazing management and range improvement on national resource lands. This alternative will result in a gradually declining level of livestock grazing management because of continuing inflationary costs. Over time, probably within 10-15 years, with continuous erosion of real purchasing power due to inflation, this alternative will become very similar to Alternative A--Custodial Management.

Environmental Impacts of the Alternative Action

1. Due to rising costs for manpower and range improvement activities, maintenance of presently existing accomplishments and programs will gradually diminish. Over time less manpower will be available for development and supervision of allotment management plans, development and maintenance of range improvement projects and range use supervision including trespass control.

2. Only the higher priority grazing administration problems would be given attention as manpower capability diminishes.

3. Livestock management actions necessary to accomplish the wild horse and burro programs, protection of rare and endangered species habitat, critical watersheds and wildlife habitat, etc., eventually could not be provided.

4. Because of the reduced capability in range management and maintenance of range improvements, range conditions would continue to decline in areas presently deteriorating.

5. Grazing allotments that are presently stabilized may be subject to future deterioration as continued management efforts lessen due to higher future costs.

6. Because of gradually declining range conditions and productivity due to diminishing management efforts, reductions in livestock numbers to balance livestock with the range carrying capacity would be necessary.

7. Watershed, wildlife, recreation and other programs on NRL will be less effective without proper management of livestock grazing.

8. Unauthorized grazing use by domestic livestock probably will increase as the capability to supervise range use diminishes. This will adversely impact other legitimate uses such as wildlife, recreation, wild horses and burros, water quality and other environmental values.

9. Range livestock operators would be subject to less control in the grazing use of forage resources on NRL.

10. Livestock operators would receive less governmental assistance in developing and implementing allotment management plans.

11. Increased private investment in the development and maintenance of supportive measures would occur.

12. The ability to accomplish the objectives of the Taylor Grazing Act, the National Environmental Policy Act and the Wild Free-Roaming Horse and Burro Act would be lessened considerably.

13. The rate at which necessary livestock management actions are taken to maintain or improve environmental quality will diminish.

14. Impact on income, employment and other direct economic indicators would be minimal overall. Unauthorized use could fully compensate for reduction in licensed AUM's occurring in controlled areas or areas lost to other uses (e.g., strip mining).

15. The major economic impact would be in terms of opportunities foregone. Failure to develop productive capacity to meet increasing demand is not compensated for by offsetting non-livestock benefits, thereby constituting a net economic loss. If the resource base is reduced, through erosion or other adverse effects, then the economic loss becomes permanent.

16. The loss of 3.5 million AUM's which could have been produced is equivalent to sales of 266,000 cattle annually (based on western states' average ratio of sales to AUM's). If this animal equivalent is produced under non-grazing conditions, costs, and therefore, meat prices will be correspondingly increased; if the AUM's are not produced elsewhere, the meat equivalent would have to be imported to avoid shortages of expected demand.

17. Because of limited manpower capability there would be little or no effort directed at designing and implementing AMP's on areas possessing wilderness value.

PART IX

CONSULTATION AND COORDINATION WITH OTHERS

Consultation and Coordination in the Development of the Draft Environmental Statement

The Bureau of Land Management completed a preliminary working draft of the Livestock Grazing Environmental Impact Statement in March 1973. During the preparation of that draft, consultations were held with representatives of user groups, professional societies, conservation organizations, the academic community and Federal and state land management agencies. In addition to selected individuals, a copy of the preliminary draft was sent to the following for review:

Federal Agencies

Soil Conservation Service
Forest Service
U. S. Fish and Wildlife Service
Bureau of Indian Affairs
Bureau of Land Management State Offices: Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah and Wyoming.

State Agencies

Utah State University
College of Natural Resources
Colorado State University
Range Science Department
University of Arizona
College of Agriculture
Department of Watershed Management

Private Groups

National Wool Growers Association
American National Cattlemen's Association
National Wildlife Federation
Society for Range Management
Natural Resources Defense Council, Inc.

The comments received were then circulated among the reviewers and the team preparing the report and some additional comments and suggestions were received. These were considered in the preparation of the draft statement. Some discussions relating to the preparation of the statement were held with members of Congressional staffs.

The statement was developed by a team of BLM employees with professional backgrounds in range management, watershed management, wildlife, forestry, recreation, minerals, economics and land use planning.

During the development of the final statement, consultation continued with groups and individuals.

Coordination in the Review of the Draft Environmental Statement

Comments on the draft environmental statement have been requested from the following agencies and state clearing houses:

Department of Agriculture
- Forest Service
- Soil Conservation Service
- Agricultural Research Service
- Economic Reporting Service

Department of Commerce
Department of Defense
Environmental Protection Agency
Atomic Energy Commission
Department of the Interior
- Bureau of Indian Affairs
- U. S. Fish and Wildlife Service
- Bureau of Outdoor Recreation
- Bureau of Reclamation
- U. S. Geological Survey

State Clearing Houses
- State of Arizona
- State of California
- State of Colorado
- State of Idaho
- State of Montana
- State of Nevada
- State of New Mexico
- State of North Dakota
- State of Oregon
- State of South Dakota
- State of Utah
- State of Washington
- State of Wyoming

Comments on the Draft Environmental Impact Statement

Comments were received on the Draft EIS from the following:

Federal Agencies	Key No.[1/]
Atomic Energy Commission	1
Environmental Protection Agency	2
Fish and Wildlife Service	3
Forest Service	4
National Park Service	5
Bureau of Outdoor Recreation	6
Bureau of Reclamation	7

State Agencies

Arizona	
State Clearing House	8
Agriculture and Horticulture Department	9
Department of Anthropology	10
Arizona Power Authority	11
Civil Rights Division, Department of Law	12
College of Earth Science--Office of Arid Land Studies	13
District IV--Council of Governments	14
Department of Economic Security	15
Department of Highways	16
Office of Economic Planning and Development	17
Arizona State Parks Board	18
Department of Health Services	19
College of Mines	20
State Liaison Officer, AORCC	21
Indian Affairs Commission	22
State Land Department	23
California	
Resources Agency of California	24
Idaho	
Fish and Game Department	25

1/ Each comment is assigned a key number. Responses to comments are identified by key number in Appendix IX-A.

State Agencies (cont'd)	Key No.
Oregon	
Fish Commission of Oregon	26
State Engineer	27
Soil and Water Conservation Commission	28
Department of Higher Education	29
Department of Environmental Quality	30
Oregon Wildlife Commission	31
New Mexico	
State Planning Office	32
Wyoming	
Department of Agriculture	33
Game and Fish Commission	34
Nongovernmental Organizations	
Albuquerque Wildlife Federation	35
American Farm Bureau Federation	36
American National Cattlemen's Association	37
Arizona Habitat Association	38
Arizona Wildlife Federation	39
California Farm Bureau Federation--June 18	40
California Farm Bureau Federation--July 16	41
Colorado Cattlemen's Association	42
Colorado Woolgrowers Association	43
Coniferous Forest Biome - IBP	44
Council for Agricultural Science and Technology	45
Denver Audubon Society	46
Foresta Institute	47
Friends of Animals	48
Idaho Cattlemens Association	49
Idaho Farm Bureau Federation	50
Montana Farm Bureau Federation	51
Montana Stockgrowers Association	52
National Association of Conservation Districts--Public Lands Committee	53
National Association of Conservation Districts--Western Representative	54
National Audubon Society - Regional Representative	55
National Council of Public Land Users	56
National Recreation and Parks Association	57
National Wildlife Federation	58
Natural Resources Defense Council	59 & a

Nongovernmental Organizations (cont'd)	Key No.
Nevada Cattlemen's Association (joint statement with Nevada Woolgrowers and Nevada Central Committee)	60
Nevada Farm Bureau Federation	61
New Mexico Cattlegrowers Association	62
New Mexico Conservation Coordinating Council	63
Oregon Cattlemen's Association	64
Oregon Environmental Council	65
Sierra Club--Northern Plains Regional Conservation Committee--June 14	66
Sierra Club--June 14	67
Sierra Club--July 11	68
Society for Range Management--Pacific Northwest Section	69
South Dakota Public Lands Council	70
Tooele County Cattlemen and Cowbelle Association	71
Utah Environmental Center	72
Wildlife Management Institute	73
Wilderness Society	74
Wilderness Society (Western Region)	75
Wyoming Farm Bureau Federation	76
Wyoming Public Land Users Coordinating Committee	77
Wyoming Stockgrowers Association	78
Wyoming Woolgrowers Association	79
Individuals	
R. A. Canning	80
Paul J. Culhane	81
Gene Etchart	82
Ralph Helm	83
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Comments in their entirety and responses thereto are in Appendix IX-A.

The responses to some comments common to several reviewers follow:

1. Many of the reviewers commented that the draft EIS was biased against or for livestock grazing. Some reviewers associated with the livestock industry stated in the comments that the statement was an indictment of the livestock industry and the BLM for the way the grazing administration program has been handled. On the other hand, some reviewers associated with environmental and wildlife groups accused the draft EIS of favoring the livestock industry and the continued grazing of national resource lands regardless of the consequences in terms of rangeland deterioration. It is acknowledged that certain discussion in the statement, if

taken out of context, may give the reader the impression that these reviewers point out. However, in covering a very complex subject like livestock grazing on national resource lands where other uses are often directly or indirectly affected, interrelationships result that sometimes support both arguments for and against livestock grazing. The statement attempts to place these interrelationships resulting from grazing management actions and supportive measures on the national resource lands into a perspective that reveals the total picture.

2. Comments made by some reviewers maintain the environmental impact statement did not give the livestock users or the BLM credit for the many improvements that have occurred on national resource lands from the time the Taylor Grazing Act was enacted in 1934 to the time when the allotment management plan or intensive management program for grazing was implemented on these lands. It is acknowledged that the ranching industry as a whole supported legislation that resulted in the Taylor Grazing Act of 1934. The livestock industry has contributed significantly to improved range conditions where they exist and have in their contributions enhanced other multiple use considerations including wildlife and watershed stability. There has been, however, in many areas strong opposition to efforts by the Bureau of Land Management to intensify management of livestock grazing. Some of this opposition is based on an historical independence where the users are of the opinion that they are doing more for improving rangeland conditions than can be accomplished through BLM efforts. Other opposition stems from the fact that improvement in management may result in reductions of livestock grazing use directly affecting the users economically.

It must be emphasized that even though improvement on certain rangelands has been the result of untiring efforts by some livestock users and Bureau of Land Management personnel the range condition on millions of acres of national resource land still continues to decline. It is this situation addressed in the environmental impact statement that must be dealt with if rangeland conditions are to be improved to provide a healthy vegetative complex and minimal soil erosion.

Reference toward accomplishments in the past attributed to any individual user, groups or organization or the Bureau of Land Management is minimized since the expressed purpose of an environmental impact statement is related to the impact of a particular program, in this case livestock grazing, on the environment.

3. Numerous comments received on the draft EIS complained that the statement was too broad and general in content to evaluate the specific impacts of livestock grazing on a localized area.

The Bureau of Land Management agrees that environmental impacts by livestock grazing would depend on the particular situation at a given local area affected by such factors as numbers and class of livestock, season of use, vegetative composition, etc. However, as was pointed out by the

Oregon Environmental Council (see Appendix IX-65) "Impacts on the land wherever they occur differ only in their degree of severity. The laws of nature are universal in affecting the life and health of vegetative organisms. The reaction of living organisms to impacts caused by overgrazing is similar whether they occur in eastern Oregon or on the plains of Texas. In both cases nature has imposed limits upon the use that can be made of an organism or individual plant without killing it." The BLM agrees with this statement and it is on this basis that the programmatic environmental impact statement is written. As stated in the second paragraph, Page I-1 of the EIS, the programmatic EIS for livestock grazing will serve as the foundation for subsequent environmental analysis and the statements that may be required. It will identify factors needing close attention in such analysis to obtain definitive information.

4. It was the contention of many reviewers commenting on the statement that the practice of allowing livestock users to invest private funds for range improvements on public lands promotes a proprietary interest on behalf of the users in those public lands.

Although discretionary, section 4 and 15 of the Taylor Grazing Act (see Appendix I-B) provides for the investment in range improvement by the authorized grazing user. In conjunction with this provision, it is pointed out in section 3 of the Act that "the issuance of a permit pursuant to the provisions of this act shall not create any right, title, interest, or estate in or to the lands (43 U.S.C., Section 315B)."

Through the issuance of section 4 and 15 range improvement permits as well as cooperative agreements for range improvement projects, millions of dollars of range improvement practices and facilities have been accomplished on the national resource lands with private funds from livestock men. Without these investments deteriorating conditions that have been halted and reversed on the public lands would not have resulted.

The livestock industry recognized the provision of section 3 of the Taylor Grazing Act with regard to creating vested interest. In those few cases where this provision of the Act was challenged through administrative procedures and the courts the provisions of the Act have been upheld.

5. Many of the comments express dissatisfaction with the economic measurement of impacts used in this statement and the dissatisfaction centers principally on quantification. The basic issues raised are:

a. The overall economic impact expressed in the statement is lower than expected or reported in other studies.

In this context, the findings of a task force of the Council for Agricultural Science and Technology are often referred to as a source of expertise.

In the Council's report of January 1974[2/] (referred to henceforth as CAST-Report) the basic statistical approach (pp. 3-4) was to compute the value of an AUM, as measured by gross receipts of livestock sales.

The CAST-Report concludes that an average value for an AUM from Federal rangeland, not including multiplier effects, is $10.00 for cattle.

This impact statement uses personal income rather than gross sales because it can be more readily compared to personal income derived from economic sectors other than livestock and from the economic process as a whole, and because it is a more direct measure of impact on people. Although personal income is measured for each region within biomes independently, the average personal income per AUM is $3.17 (Table III-4). Using the income data from Table III-4 and gross sales as reported by the Census of Agriculture (1969) a sales-income ratio of $3.18 is obtained, i.e., for each $3.18 of sales one dollar of personal income is derived. Therefore, multiplying the two ratios ($3.17 x $3.18) yields an estimate of gross sales receipts per AUM based on data used in this statement--this figure is $10.08. Consequently, the two measures of direct impact effects are compatible; the personal income approach has been used for reasons stated earlier.

b. The "multipliers" used to assess secondary impacts appear low.

The CAST-Report estimates an 11 Western States multiplier of 2.25 (page 4), while this statement estimates multipliers for each region within biomes independently with an average multiplier effect over the 11 Western States of 1.5 (Table III-4). A multiplier based on sales may not be directly comparable to a multiplier based on industry generated personal income because the ratio between sales and income varies between economic sectors depending upon costs of production other than wages, salaries and proprietor's income.

Nevertheless, multipliers do vary between regions and are typically below 2.0. For example, the Public Land Law Review Commission reported on six subbasins with a relatively high percentage of NRL, based on input-output studies; subbasin multipliers were (PLLRC--The Forage Resource, Vol. 2, page III-98):

1.	San Juan	1.58
2.	Gila	1.50
3.	Upper Main Stem	2.38
4.	Little Colorado	1.42
5.	Green	1.98
6.	Lower Main Stem	1.41

In order to estimate impacts by biome, this statement utilized a model which relates personal income generated in 16 economic sectors to a matrix of

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2/ Task Force of the Council for Agricultural Science and Technology; Livestock Grazing on Federal Lands in the Eleven Western States; January 1974.

expected transactions between sectors, with multipliers computed by industry based on net exports from the region. In the opinion of the authors of this statement, the multipliers shown in Table III-4 provide a better estimate of secondary income impacts within biomes than would an overall estimate for the 11 Western States, or separate studies which do not conform to biome configuration; however, the reader is free to multiply the direct personal income impacts of Table III-4 by any multiplier deemed to be more accurate to arrive at secondary impacts.

c. The methodology used does not fully express the true economic value of grazing NRL.

This remaining major issue, measuring a "true economic value" of an AUM provided by NRL, arises from the fact that many of the AUM's are provided on a seasonal basis providing critical feed for a portion of the year. Hence, an average measure per AUM may not reflect a "true value" because its percentage contribution to total feed is small compared to its critical nature during a portion of the year. This argument is of less significance on the 21 percent of Federal range which is grazed yearlong (CAST-Report pp. 4-5). Most economists agree that the economic value of a resource is best measured at the margin rather than as an average and that this is adequately done by "shadow prices" computed by linear programming models. Such a study[3/] was made on four ranches which used NRL for seasonal grazing; alternative range improvements were considered, and seasonal marginal value products (MVP's) were computed. Interpolating this data at the level of investment associated with the grazing program described in this statement (average cost per acre), the monthly MVP's of public grazing would vary between zero to over $7.00 per AUM, with an average MVP of $3.94. This value is higher than the $3.16 of personal income used in this statement and considerably lower than a $10.08 gross sales measure--not to imply that either of these measures purports to be an MVP estimate.

Since the issue of a "true economic value" is highly technical and MVP's of seasonal public grazing are not available for all areas, and since the personal income measure used in this statement is compatible with estimates made on a gross sales basis, there appears to be no reason to revise the statement text regarding measurement of economic impact. To do so would be to add confusion rather than clarity. The measures used in this statement appear adequate to indicate the relative economic impact of the grazing program and described alternatives on the livestock industry, regional economies and the population as a whole. In cases where individual impacts become significant, they will be addressed in separate impact statements as required by NEPA.

6. Reviewers have expressed the opinion that the environmental impact statement represents a budget justification. For the benefit of the

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3/ Darwin B. Nielsen, et al; Economies of Federal Range Use and Improvement for Livestock Production; Tech. Bull. No. 92, Agr. Exp. Sta., Oregon State University; June 1966.

reviewers who made this comment, the preliminary draft statement circulated through a broad cross section of the public and some of those reviewing that draft expressed the opinion that it was difficult to assess the Bureau's livestock grazing management program unless there were some specific goals and objectives in terms of time frame, for implementing the intensive management program. In addition, the same reviewers formerly contended that a general assessment of the cost of implementing such a program was a necessity in the statement. Consequently, this general information concerning goals and reflecting costs of the program and comparative receipts from grazing fees including those portions of the fees which are designated for the range improvement fund are presented in the environmental impact statement.

7. Comments with regard to the disposition of 10 million acres resulting in loss of acreage available for livestock grazing has resulted in a brief revision of the text to clarify this discussion. On page I-16 of the Public Land Law Review Commission report dated June 1970, the following two paragraphs are quoted to clarify the meaning of this discussion.

> "Historically, all public lands which could be physically negotiated by livestock have been grazed. Lands with steep topography and unsuitable soils, as well as lands in delicate ecological balance have been subjected to such use. Failure to recognize the limitations imposed by nature on lands of this sort has caused extensive damage to property and other resources and has required massive expenditures for rehabilitation. The results have not been desirable for either the livestock operators or society.
>
> Such frail and deteriorated lands should be identified, as well as those chiefly valuable for grazing. Once identified they should be classified as lands not suitable for grazing, and we recommend that grazing in such areas should be prohibited to the fullest extent practicable."

In addition to those types of lands described in the Commission's report, the Bureau recognizes that in view of the dynamic programs that are now taking place on the national resource lands (e.g., mineral, recreation, etc.) there will be, through the Bureau planning system process with assistance of public participation, decisions affecting some areas of land that are presently grazed by livestock that will be designated for other higher priority uses. At this time the estimate is that approximately 10 million acres of national resource lands will come within the scope of the above descriptions and will be lost to livestock grazing. Such land use decisions may have a significant economic impact on an individual livestock user but will not adversely impact the total livestock industry dependence on national resource lands in the long term.

8. Many reviewers of the draft EIS question the statement on Page I-4: "Overgrazed ranges will improve more rapidly with proper livestock grazing than with no livestock grazing."

The statement is defendable for several documented reasons. Many studies have been conducted involving exclosures (total exclusion of livestock grazing) where vegetative parameters have been compared within the exclosure and outside where proper grazing is occurring. Almost without exception, vegetation outside the exclosure when properly grazed, has been superior in terms of vigor, ground cover, production, seed production, seed viability and composition than that within the exclosure. After a period of years of "no grazing," vegetation within the protected area becomes stagnant with very little new growth and few seed stalks produced. The buildup of litter year after year provides a haven for small rodents and burrowing animals. Frequently, extensive soil disturbance by these animals provides opportunity for weedy species to invade the exclosure.

The primary and basic reason for the results briefly described above is the morphological and physiological adaptations of grasses and other range plants to grazing. The location of meristematic tissues and buds in grasses are adaptations to grazing which have evolved over a long period of time and grazing use. Grazing stimulates axillary buds to put forth new shoots. Winter grazing of the vast wheat fields of the Great Plains has, as one primary purpose, to stimulate axillary buds to produce more shoots and seed heads and thus, reap a greater harvest of grain. Such grazing significantly improves the production.

Although meristematic tissues and buds of shrubs species are located differently than in grasses, and shrubs differ from grasses in the way they grow, the principles are essentially the same. When animals graze the tips of branches on shrubby species, lateral adventitious buds are stimulated to produce new shoots. Without grazing, this branching and new shoot development does not occur to the extent that it occurs with grazing. This principle is applied in home landscaping where hedges and shrubs are trimmed back to stimulate lateral branching and provide a more compact hedge or shrub growth form. Therefore, having evolved over long periods of grazing use and being thus adapted to use by herbivores, grasslands and shrublands actually remain in better condition and are more productive if properly grazed than if left ungrazed.

Livestock can be used to trample ripe seed into the soil, speeding up the process of new plant establishment on open bare soil. Without grazing, this process will take much longer. Grazing use can be designed and timed to favor one plant species or community over another. For example, a shrub community might be provided an ecological advantage by grazing competing grasses during the season when grasses are particularly susceptible to damage from grazing pressure. Without grazing, these grasses would provide heavy competition for the shrub species.

The domestic grazing animal is under the control of man regarding time, season, frequency and intensity of grazing use. Man can manipulate this

grazing use to accomplish specific physiological and ecological responses in the vegetation. Without grazing, man has lost the use of this powerful "tool."

9. Many comments made by the reviewers point out that the statement should address other multiple uses of the national resource lands including wildlife management, wild horses and burros, recreation, energy development and consumption, etc. Preparing a treatise on each of these subjects would fall outside the scope of the intended purpose of this environmental impact statement. That is, the environmental impact of the Bureau's livestock grazing management program on national resource land. The Bureau has prepared or is in the process of preparing other environmental impact statements that deal with those subjects referred to by the reviewers in their comments on the draft EIS.

10. Some of the reviewers have criticized the alternatives that have been presented in the environmental statement. It was generally agreed by most reviewers that alternatives B--No Grazing and C--Maximizing Livestock Grazing are too extreme to be seriously considered as reasonable alternatives. An analysis of the present livestock grazing management program on national resource lands as presented under Part I will show that actions that can be taken under this program represent a middle ground between these two extremes. However, within this middle ground certain management practices could be implemented that would trend toward one or the other of alternative B and C.

The reviewers will note that some comments received on the draft EIS support alternative B--No Grazing and others support alternative A--Custodial Management. Some support alternative D. Specific comments reflected the need for an alternative which would be a continuation of the present program in varying degrees. An additional alternative E--No Change in Present Program is being added.

11. Several reviewers objected to what has been inferred as a general theme throughout the EIS that habitat for wildlife will always be improved through proper grazing management. Although such a "blanket" generalization is certainly not true and was not intended by the EIS, management options available to the resource manager can significantly improve wildlife habitat depending on the particular situation. For example, a well-designed grazing system which provides more vegetative food and cover and a greater variety of plant species will benefit many forms of wildlife. Where rare and endangered species habitat or aquatic habitat is adversely impacted by domestic livestock grazing, removal of domestic animals may be the answer. Deferment of grazing use from known strutting grounds or nesting sites for waterfowl may be appropriate. Changing season of use may prevent winter sheep use on critical winter deer habitat. It may be necessary in some circumstances to graze domestic livestock heavily during certain seasons to permit increases in shrubs and forbs necessary for certain wildlife.

These are but a few examples of management actions which can be taken to benefit wildlife habitat. Each situation must be analyzed separately, resource management objectives identified and the appropriate livestock management action implemented to achieve these objectives.

Some reviewers expressed concern that certain supportive measures (chaining, seeding and spraying) would reduce cover for wildlife, while other range improvements such as fencing would adversely affect wildlife migrations and other natural wildlife processes. The estimated acreage of rangeland conversion which remains to be accomplished as shown in Table I-1, represents less than 4 percent of the livestock grazing area. In most cases rehabilitation projects to benefit livestock would simultaneously improve wildlife forage with little adverse impact on habitat protection. All supportive measures, including fencing, will consider wildlife habitat requirements as identified in the land use plan for a given geographic area.

GLOSSARY OF WORDS AND PHRASES USED IN THIS ENVIRONMENTAL IMPACT STATEMENT

Adjustments in Numbers - Change (increase or decrease) of livestock numbers to conform to the amount of forage produced in an area, considering other multiple uses.

Adventitious Growth - Vegetative growth originating from plant parts not normally producing growth.

Algae Bloom - An abundant growth of plankton algae during hot weather that turns the water green and perhaps toxic.

Allotment - An area of land where one or more individuals graze their livestock. It generally consists of national resource lands but may include parcels of private or state owned lands. The number of livestock and season of use are stipulated for each allotment. An allotment may consist of several pastures or be only one pasture.

Allotment Management Plan (AMP) - A concisely written program of livestock grazing management, including supportive measures, if required, designed to attain specific management goals in a grazing allotment.

Animal Unit Month (AUM) - The amount of forage required to sustain the equivalent of one cow or five sheep for one month.

Aquifer - A water-bearing bed or stratum of permeable rock, sand, or gravel capable of yielding considerable quantities of water.

Aspect - The orientation of a slope in respect to the compass; a position facing or fronting a particular direction.

Biome - An ecological formation considered in terms of both plants and animals of the area concerned and usually identified in terms of the characteristic vegetation.

Biotype - All the organisms sharing a specified similarity, such as all the species of one genus.

Browse - As a verb, to consume, or feed or eat on (a plant); as a noun, the tender shoots, twigs, and leaves of trees and shrubs often used as food by cattle, deer, elk and other animals.

Catchment - A structure built to retain water from an upstream drainage area.

Changing Season of Use - Adjusting the time of livestock grazing on a range area based on type of vegetation or stage of vegetation growth.

Chlorinated Hydrocarbon - A chemical compound containing chlorine, hydrogen and carbon. An example is DDT.

Class of Livestock - Kinds of domestic livestock grazing on a range - cattle, horses, sheep or goats, or a combination of these. May be broken down to greater detail such as cows with calves, yearlings, steers, ewes, ewes with lambs, lambs, etc.

Climax - The final vegetative community which emerges after a series of successive vegetational stages and perpetuates itself indefinitely unless disturbed by outside forces.

Cool-Season Grass - A plant which makes the major portion of its growth during late winter, early spring, and again in the fall (during the cool seasons).

Critical Wildlife Habitat - That portion of the living area of a wildlife species that is essential to the survival and perpetuation of the species either as individuals or as a population.

Decreaser - A plant species of the original vegetation that will decrease in relative abundance with continued overuse.

Deferment - Withholding of livestock grazing until a certain stage of plant growth is reached, usually maturity of seed.

Distribution - The uniformity of livestock grazing use over a range area. It is affected by water availability, topography and type and palatability of vegetative species.

Dual Use - To allow use of more than one class of livestock on the same area, at either the same time or at different times of the year.

Ecosystem - An ecological community considered together with the non-living factors of its environment as a unit.

Ecosystem Components - The animals, vegetation, soil, water, minerals, solar energy and their interactions as an ecological community.

Ecotone - A transition area between two adjacent ecological communities usually exhibiting competition between organisms common to both.

Environment - The surrounding conditions, influences or forces that affect or modify an organism or an ecological community and ultimately determine its form and survival.

Eutrophication - The accumulation and retention of nutrients by aquatic ecosystems to the stage where vegetative decay exceeds the available oxygen supply.

Flexible Herd Composition - Usually refers to maintaining a herd of grazing animals composed of a basic breeding herd plus steers and heifers so that rapid adjustments in numbers can be made as a result of favorable market conditions, drought, or other natural factors. For example, steers and heifers can be marketed immediately as a result of deficiency of forage due to drought.

Forb - A broadleaved herb, a weed.

Frail Lands - Some areas which exhibit low productivity and stability. Surface disturbance readily accelerates erosion of these areas.

Frequency of Use - An expression of the periods of grazing use and non-use describing how often and for how long grazing occurs.

Grazing District - An administrative subdivision of the rangelands under the jurisdiction of the Bureau of Land Management, established pursuant to the Taylor Grazing Act of June 28, 1934. Section 3 lands are those national resource lands within a grazing district boundary pursuant to Section 3 of the Act.

Section 15 lands are those national resource lands outside a grazing district boundary pursuant to Section 15 of the Act.

Grazing System - A systematic sequence of grazing use and nonuse of an allotment to reach identified multiple-use goals or objectives by improving the quality and quantity of the vegetation.

Herbivore - A plant-eating animal.

Humus - Accumulated debris of plant stems, leaves and roots forming the organic material in soils.

Increaser - A plant species of the original vegetation that increases in relative abundance, at least for a time, with grazing use.

Intensity of Use - Amount of vegetation consumed by grazing herbivores, usually measured as a percentage of the annual growth.

Invader - A plant species that was absent in the undisturbed portions of the original vegetation but will become established therein under conditions of disturbance or continued overuse.

Lagomorph - An animal of the Order Lagomorpha represented by hares, rabbits and pikas. They resemble rodents and were formerly classified as such, but were separated from rodents on the basis of dental characteristics.

Lay-Down Panel - Fencing constructed so that sections can be lowered from the vertical position when not needed to prevent snow damage or permit passage of wildlife species.

Lease - An authorization permitting the use of national resource lands outside of a grazing district for the grazing of livestock during a specified period of time.

License - An authorization which permits the grazing of a specified number and class of livestock on a designated area of grazing district lands for a period of time, usually not in excess of one year.

Livestock Operation - The management of an area of land so that a significant portion of the income is derived from the continuing production of livestock.

Management Action - A supervisory decision affecting the manner and method of use of the resources of a land area.

Management Framework Plan (MFP) - Land use plan for national resource lands which provides a set of goals, objectives and constraints for a specific planning area to guide the development of detailed plans for the management of each resource.

Microclimate - The local climate of a given site or habitat of variable size.

Microfauna - The small or strictly localized animal forms of an area, usually referring to minute forms perhaps invisible to the naked eye.

Moisture Infiltration - Water penetration into the soil through pores of the soil. Rate and amount of infiltration is limited by size and abundance of pores and water absorption capability of the soil.

Multi-Discipline Team - A group of persons who collectively have expertise on all aspects or components of a project or problem to be studied and/or solved.

Multiple Use - Harmonious and coordinated management of the various surface and subsurface resources, without impairment of the land, that will best meet the present and future needs of the people.

Multiplier Effects - The amount of additional income expected to be generated in all sectors of a regional economy as a result of an increase or decrease in income of the livestock sector.

National Resource Lands (NRL) - Public lands administered by the Bureau of Land Management.

Nonwettable Soils - A condition of the soil which may occur after wildfire where the soil loses its affinity for water.

Off-Road Vehicle (ORV) - Any motorized vehicle designed for or capable of cross-country travel on or immediately over land, water, sand, snow, ice, marsh, swampland or other terrain.

Overgrazing - Consumption of vegetation by herbivores beyond the endurance of a plant to survive.

Parent Material - The unconsolidated and more-or-less chemically weathered mineral or organic matter from which soil develops.

Pasture - As used in this document, a pasture is a subdivision of a grazing allotment on national resource lands. For example, the allotment is divided into three pastures.

Permit - An authorization which allows the grazing of a specified number and class of livestock on a designated area of grazing district lands during specified seasons each year for a period of usually 10 years.

Phenoxy Chemical - A compound containing the univalent radical $C_6 H_5(-)$, an acid common to herbicides such as 2, 4-D; 2, 4, 5-T and silvex. As hormonal-type herbicides, they stimulate natural plant hormones and cause uncoordinated growth, accelerated metabolism and eventual death of the plant.

Physiological Needs of Plants - Requirements of vegetation to survive, the need to manufacture food, to replenish food reserves, to produce viable seed, and to have new seedlings become established.

Plant Density - The number of individuals per unit of area. Refers to the relative closeness of individuals to one another.

Plant Growth Requirements - Similar to physiological needs of plants but more specific; pertains to requirements of soil for rooting, water, minerals, light and air.

Plant Vigor - The relative well being and health of a plant as reflected by its ability to manufacture sufficient food for growth and maintenance.

Predator - An animal that preys on one or more other animals that man wishes to preserve for his own use.

Programmatic Statement - A comprehensive and general statement resulting from an analysis of the adverse and beneficial impacts on the environment as it is being affected by an ongoing management program.

Public Land Law Review Commission (PLLRC) - The Commission established by Public Law 88-606 on September 19, 1964, to study existing laws and procedures relating to the administration of the public lands of the United States.

Public Participation - A component of the Bureau Planning System providing the opportunity for citizens as individuals or groups to review resource management proposals and offer their suggestions or criticisms of the various alternatives offered.

Range Adjudication - The allocation of grazing allotments, season of use, numbers and class of livestock to qualified livestock operators.

Range Condition and Trend - A description of the current status and estimated future improvement or deterioration of the vegetation and soil.

Range Conservationist - A person trained in the use and management of natural resources in accordance with principles that assure a sustained yield of renewable benefits and values without impairment of environmental quality.

Range Improvement - A structure, action or practice that increases forage production, improves watershed and range condition, or facilitates management of the range or the livestock grazing thereon.

Regional Economics - Of, relating to, or concerned with the production, distribution and consumption of commodities and services on a regional area basis as compared to a local or national basis.

Rest - As used in this statement, refers to deferment of grazing on a range area to allow plants to replenish their food reserves.

Root Plow - A machine designed to cut the roots of woody-plant species below the soil surface. Root plows require a tractor of high horsepower and are usually mounted on the rear of crawler-type tractors.

Rotation - A grazing system providing for sequential movement of livestock from one pasture to another on the basis of allowing for regrowth of vegetation and maintenance of vegetative vigor.

Roughness Coefficient - Terminology expressing the proportional relationship between the velocity of water flow in natural channels to the roughness of the channel as influenced by obstructions such as vegetation and boulders.

Secondary Poisoning - Physiological impairment or death caused to an animal as a result of eating an animal that has died from ingestion of poison.

Sedimentation - The action or process of deposition of material borne by water, wind or glacier.

Sheep Campsite - Those areas, usually consisting of less than 1 acre of land that are used annually by the sheep men who move their small camp trailers or tents to the campsite as the sheep are grazed in the nearby vicinity until they are moved on the new areas. The camps are usually established for a period ranging from a few days to a few weeks.

Single Use Potential - The maximum production of a resource such as forage, without environmental or policy constraints.

Stocking Rate - The degree to which a grazing unit is stocked with livestock, usually expressed in AUM's. The stocking rate may be more or less than the carrying capacity.

Strutting Ground - A localized area used by some species of the grouse family to display their courtship rituals.

Supportive Measures - Structures, actions or practices where objectives or justifications are to increase forage production and utilization, to improve range conditions, or to facilitate management of the range or the livestock grazing thereon; range improvements.

Tree Crusher - A self-propelled machine that moves on large diameter steel rollers studded with cutting blades. It utilizes power and weight to push trees and brush down and crush or splinter them. One of the larger machines weighs 55 tons and takes a swath of 26 feet.

Ungulate - A hoofed animal.

Utilization - The proportion of current year's forage production that is consumed or destroyed by grazing animals. Usually expressed as percentage. See also Intensity of Use.

Warm Season Grass - A plant which makes most or all of its growth during the spring, summer or fall and is usually dormant in winter; grows during the warm seasons.

Appendix I-A

BOISE FRONT

ALLOTMENT MANAGEMENT PLAN

11-01-35-01

BOISE FRONT PLANNING UNIT

BOISE DISTRICT

BUREAU OF LAND MANAGEMENT

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APPROVAL

The following plan is prepared to meet criteria necessary for a coordinated Resource Management Program over 14,700 acres of land contained in the Boise Front Watershed. This plan will serve as the basis for cooperative management among the Idaho Fish and Game, Forest Service, Bureau of Land Management, Highland Livestock and Land Company, Claude Wiseman, Lee White & Son, and Larry Smith.

Approved by
Idaho Fish and Game

/s/ John R. Woodworth Date 03-20-70
Director

Approved by
Forest Service

/s/ Charles T. Coston Date 03-20-70
Acting Supervisor,
Boise National Forest

Approved by
Bureau of Land Management

/s/ Joe T. Fallini Date 04-17-70
State Director

Approved by
State Land Board

/s/ Gordon Trombley Date 03-23-70
Commissioner

OPERATION AGREEMENT

BY

Highland Livestock & Land

Lee White & Son

Larry Smith

Claude Wiseman

We the undersigned have reviewed the Boise Front Allotment Management Plan and understand its provisions. We understand that the Program outlined both during the interim period and under the Rest Rotation System will serve as a basis for our respective licensed use. We agree to operate our cattle and sheep in the manner prescribed by the designated authority except as adjusted from time to time under mutual agreement. We also understand that development and maintenance of management facilities will be subject to mutual agreement in provisions of funds, labor, material, and equipment of all parties involved. We also agree that said agreement will be binding upon assignees in the manner previously outlined.

Highland Livestock & Land Company
By /s/ Robert M. Naylor DATE 02-18-70
President

/s/ Claude Wiseman DATE 03-11-70
Rancher

/s/ Lee White & Son DATE 03-10-70
Rancher

/s/ Larry R. Smith DATE 04-09-70
Rancher

I. INTRODUCTION

This allotment Management Plan is designed to outline a Grazing Management System, which is compatible with other use demands and resource needs.

This system has been especially devised to fulfill the outlined objectives in Section II of this plan.

The following ownerships make up a total of 17,020 acres:

1.	Idaho Fish & Game Department	5,420
2.	Fish & Game State Lease	640
3.	Bureau of Land Management	6,160
4.	Highland Livestock and Land	800
5.	Claude Wiseman	360
6.	Lee White	1,120
7.	State of Idaho	640
8.	Black Hornet Mine	60
9.	U. S. Forest Service	1,820
		17,020
		240 Private Land
		17,260 of non-user

Background

Location

The center of the area is approximately 7 - 8 miles from Boise, Idaho, due north of Lucky Peak Reservoir, in Townships 2 & 3 North, Ranges 3 & 4 East, more commonly known as the Boise Front, see Exhibit 1.

History

Domestic livestock have grazed the area on a continuous year-long manner since the late 1800's. Studies made by the Idaho Fish & Game Department indicate that the area is one of the most critical mule deer winter ranges for the largest and most productive mule deer herd in the State. Prior to the construction of Lucky Peak Dam, it also served as a deer migration route from the Boise Ridge Area to the Snake River plains.

Social-Cultural Demands

Livestock grazing, big game and upland game bird hunting, hiking, motorbiking and horseback riding are the most important demands on the resources involved. A 50% increase during the next 20 years over the present 18,000 visitor days per annum is predicted.

Climate

The Boise Front has cold winters and dry, hot summers. Average annual temperature extremes are approximately 0^{o} to 100^{o} F. In winter months average daily maximum and minimum temperatures are 39^{o} and 27^{o} F. Average daily maximum and minimum temperatures during the summer are 84^{o} and 55^{o} F. The frost-free season ranges from 120 - 159 days on the Front. The upper reaches of the area receive 18 to 20 inches of precipitation annually; Boise receives about 10 to 12 inches per year. The majority of the moisture received on the Front is snow.

Topography

The majority of the slopes are moderately steep with about one-fourth of the area having slopes greater than 30%. Generally slopes face a south-southwesterly direction. Elevations range from 2800 to 5968 feet. Warm Springs Creek, Squaw Creek, Maynard Gulch, Highland Valley Creek plus two more small unnamed drainages are the major drainages.

Soils

All of the planning area is in the Chestnut Brown Litholsal great soil group. Most soils are formed from Lake sand deposits and granitic rocks. Both parent materials produce angular grained, poorly graded and erodible soils. Deep gulches have been cut where the soil has been disturbed and vegetation removed.

Wildlife

Wildlife habitat is in fair to poor condition due to fires, erosion and excessive grazing. Principle wildlife species are mule deer, chukar partridge, Hungarian partridge, valley quail, mourning dove, and cottontail rabbits. Other small mammals, songbirds, etc., are indigenous to the Front; however, all species will become more numerous with improved habitat. Large winter deer populations constitute a critical use pressure which may be alleviated through the proposed plan of management.

II. OBJECTIVES

General

1. To generate development of the multi-ownership 14,700 acre area using livestock as a tool under a systematic grazing formula.

   A. To stabilize watershed.

   B. To sustain an important deer population.

   C. To provide recreational opportunities.

   D. To produce forage for a stabilized livestock industry.

Specific

Specific objectives must be declared in projective quantitative outcomes, then measured by an evaluation procedure which is Part IV of this plan. The following specific objectives indicate what benefits will be derived by cooperating individuals or agencies:

Rancher	Idaho Fish & Game Department Bureau of Land Management Forest Service
Items generally weighed on economic values	Items weighed on Resource and Multiple Use Values
1. Grazing season longer March - October	1. Increase bitterbrush density by 15%. Increase deep-rooted perennials from 25% to 80%.
2. Reduce operating costs in handling livestock by 15%.	2. Mutually plan, design & stake fences & water developments, eliminating excessive livestock movement.
3. Improve produce for market (Increase weiner weights 5%).	3. Limit erosion; heal gullies; raise local water table.
4. Allowable AUMs increased proportionately over present license numbers.	4. Achieve proper vegetative management, which in turn will provide more feed for wildlife & domestic stock.
5. Value of ranch permit will increase.	5. Public will receive increased revenue through accelerated local economy.

6. Maintenance of range developments provided by Fish & Game & BLM as funds & labor become available.	6. Provide for a scheduled maintenance program based on prescribed need.
7. Improve perennial cover on private land from 10%-45%. Improve browse from 20%-50%.	7. Increase habitat for mule deer & other forms of wildlife. This would increase the existing effective area managed by Fish & Game 30%-40%.
8. Regulate unauthorized and damaging trails.	8. Make possible opportunity to set aside and regulate areas for hiking, horseback riding, and motorbike trails.
9. Value of base property will increase.	

III. JUSTIFICATION

The following criteria will serve to justify the development of this AMP.

Increased Efficiency of Livestock Management

Due to the homogenous land pattern created by the Idaho Fish and Game acreage contribution a practical grazing system, which will enhance the operator's margin of profit (with this added acreage under the systematic plan of management outlined in Part IV, livestock will utilize more and better feed, and will make gains throughout the season).

Wildlife

The planning area is a major portion of the Fish & Game's Unit #39 deer winter range, one of the most critical winter areas for mule deer within the state. The grazing system outlined in Part IV will:

1. Provide needed rest for grass and browse species.
2. Increase vigor of species.
3. Increase composition of desirable grasses and browse.
4. Increase volume of feed.
5. Improve an additional 9,390 acres of habitat under a management system for big game, various species of small game and upland game birds.

Economic Consideration

The following data has been compiled by the Idaho Fish & Game Department:

Mores Creek Checking Station Records For
Game Management Unit #39
Mule Deer Harvest

Year	Length	Indicated Total Kill Mule Deer	Total Checked Kill Mule Deer	Total Hunters Checked (approx. 40% of total)	Trend Counts
1959	58 days	7,421	2,480	22,057	None
1960	51 days	6,081	2,269	20,312	2,742 ground count
1961	30 days	3,458	1,555	14,551	1,338
1962	48 days	5,803	2,261	20,529	1,970
1963	37 days	5,159	2,020	20,627	1,358
1964	47 days	7,544	2,875	22,177	2,554
1965	57 days	5,876	2,394	24,978	None
1966	51 days	5,708	2,260	24,932	None
1967	50 days	6,028	2,269	23,461	None
1968	45 days	8,100	3,290	24,247	7,167 helicopter
Average	47 days	6,118	2,367	21,787	

The above figures indicate an annual deer harvest of 6,118 animals with an estimated 54,465 hunter days a year. Using a conservative average figure of $20.00 per hunter day, this amounts to $1,089,300 per annum, resulting in a tremendous impact on the local economy. The 14,700 acres involved in the system is the heart of the winter deer range for Unit #39.

Watershed

U. S. Soil Conservation Service studies estimate that silt production throughout the area averages 1.7 cubic yards per acre per year. Therefore, the 14,700 acres under this plan are producing about 25,000 cubic yards of sediment in their present state. Under proper management increased composition of perennial grasses could reduce sediment yield as much as 50% or 12,500 cubic yards.

Recreation

Approximately 175,000 people live within 50 miles of this area. The present population spends an estimated 18,000 visitor days a year on the area with 80% of the use either hiking, horseback riding, or motorbike riding. With a well-planned grazing system recreation uses and expected future uses can be incorporated into a regulated land use plan.

Cooperative Efforts

Under a system of management, cooperative planning among all interested groups, Boy Scouts, Girl Scouts and other conservation groups, will be greatly enhanced. These groups are anxious to help and, under proper supervision, could accomplish such things as browse and tree planting, construct gully plugs, trail building, and habitat development.

IV. GRAZING MANAGEMENT SYSTEM

The management system will be outlined in five parts:

1. Proposed Grazing System
2. Interim Management System
3. Sequence of Range Improvements
4. Licensing Procedure
5. Evaluation Procedure

Proposed Grazing System

After careful consideration and on-the-ground inspection with the ranchers, Idaho Fish & Game, BLM, U. S. Forest Service and Mr. Gus Hormay, an eight (8) pasture system with four high pastures ranging in elevations from 3600' to 5900', and four low pastures ranging in elevations from 2830' to 3600', system was agreed on in order to best meet our objectives set down in Part II of this plan. The following tables will describe the grazing formula and the yearly grazing schedule for the eight pasture system.

GRAZING FORMULA FOR THE HIGH PASTURE SYSTEM

	TREATMENT	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
A	Graze for max. livestock production.												
B	Rest for twig & seed development.												
C	Rest for bitterbrush seed & seedling estab.												
D	Graze for seed trampling.												

Start of growth — Flowering — Seed ripe — Apply this treatment if indicated-optional treatment

YEARLY GRAZING SCHEDULE

	MANAGEMENT UNIT	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
First Year 19 70	High Pasture #1												
	High Pasture #2												
	High Pasture #3												
	High Pasture #4												
Second Year 19 71	High Pasture #1												
	High Pasture #2												
	High Pasture #3												
	High Pasture #4												
Third Year 19 72	High Pasture #1												
	High Pasture #2												
	High Pasture #3												
	High Pasture #4												
Fourth Year 19 73	High Pasture #1												
	High Pasture #2												
	High Pasture #3												
	High Pasture #4												
Fifth Year 19													
Sixth Year 19													

GPO 844 - 885

GRAZING FORMULA FOR THE LOW PASTURE SYSTEM

TREATMENT	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
A Graze for max. live-stock production.												
B Rest for twig & seed development.												
C Rest for bitterbrush seed & seedling estab.												
D Graze for seed trampling.												

Start of Growth

Flowering

Seed Ripe

Apply this treatment if indicated-optional treatment

YEARLY GRAZING SCHEDULE

	MANAGEMENT UNIT	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
First Year 1970	Low Pasture #1												
	Low Pasture #2												
	Low Pasture #3												
	Low Pasture #4												
Second Year 1971	Low Pasture #1												
	Low Pasture #2												
	Low Pasture #3												
	Low Pasture #4												
Third Year 1972	Low Pasture #1												
	Low Pasture #2												
	Low Pasture #3												
	Low Pasture #4												
Fourth Year 1973	Low Pasture #1												
	Low Pasture #2												
	Low Pasture #3												
	Low Pasture #4												
Fifth Year 19													
Sixth Year 19													

GPO 844 - 885

The formula will accomplish the following for perennial grasses and bitterbrush:

Perennial Grasses	Bitterbrush
1. Restore vigor	1. Produce vigor & provide more forage through maximum hedging.
2. Increase perennial composition.	2. Provide the required two years rest for maximum twig and seed production.
3. Allow for reproduction. a. Increase seed production b. Establish seedlings	3. Increase bitterbrush density through more seed production & seed planting through trampling.
4. Provide additional litter. a. Replace mineral elements b. Limit erosion	
5. Increase soil moisture and reduce soil temperature.	

The following numbers of livestock will begin the system:

1. Highland Livestock and Land - Three (3) to four (4) bands of sheep during early spring and mid-fall.

2. Lee White & Sons - 94 cattle - early spring to late fall.

3. Larry Smith - 35 cattle - early spring to late fall.

4. Claude Wiseman - 60 cattle - early spring to late fall.

Approximately 3000 - 4000 sheep during early spring and mid-fall with a total of 189 cattle from early spring to late fall will be used initially in the grazing system. If the initial number of livestock is not enough to accomplish the objectives set out in Part II, the present users will be increased up to their base property qualifications.

Cattle Grazing Procedure

Begin grazing season by turning out stock in the early*1 spring in Low Pasture #1. Cattle will remain in this pasture until it is determined that the bitterbrush will be properly hedged or until stock shows first signs of listlessness or dropping off. Then the gates will be opened in High Pasture #1. The stock will be allowed to drift into the higher pasture at their leisure. These two treatments are both the high and low A Treatment.

The D Treatments will be applied to each system if needed. If the pasture set up for the D Treatment shows a good bitterbrush seed crop, stock will be moved into it to accomplish the desired seed planting through trampling. This A and D Treatment will be the sequence of grazing maintained through a four-year cycle. The fifth year will be the beginning of the second cycle using the same procedure. See Pages for a description of the four-year cycle in both the low and high pastures.

Sheep Grazing Procedure

During any one grazing year there will be four pastures, two in low pasture unit and two in the high pasture unit, that can receive grazing pressure. The sheep will be able to graze in either A Treatment in the spring or D or A Treatments in the fall. Their area of use will be determined each year prior to the season.

Forest Service Pasture

The Forest Service Pasture commonly referred to as the Dead Dog Allotment, approximately acres, will be used as a late summer pasture in the event a severe draught, fire and other act of God might occur in the system.

Numbers and time will be within the following limits:

1. No grazing prior to August 15th in any one year.
2. Numbers will not exceed 100 head.
3. Season will not exceed one month's use.

*1 Turnout date will be agreed to by users, Idaho Fish & Game & the BLM each year.

Interim Management

Interim management is that period of time before the proposed grazing system is initiated. During this period the operators will run just as they have in the past. When the needed facilities such as springs, pipelines, fences, and cattleguards have been constructed, the grazing system will begin.

The involved operators will be licensed as follows during the interim period:

1. Highland Livestock and Land

   Highland is currently licensed in the spring for three bands of sheep between 5-1/6-30 and in the fall for three bands 10-25/11-30. Numbers and time vary according to the year.

2. Larry Smith

35 cattle 4-1/6-30	31% Federal Range	33 AUMs
35 cattle 9-15/12-31	31% Federal Range	38 AUMs
		71 AUMs

3. Lee White & Son

94 cattle 4-16/9-30	51% Federal Range	194 AUMs

4. Claude Wiseman

Field #1	60	(one month use between January 1 & April 1)	11% Federal Range	6 AUMs
Field #2	57	11-1/12-31	20% Federal Range	23 AUMs
Field #3	28	3-15/5-15	100% Federal Range	56 AUMs
Field #4	23	5-15/8-30	70% Federal Range	56 AUMs
Field #3	23	10-15/12-31	100% Federal Range	199 AUMs

Proposed Development Sequence of Range Improvements

Priority	Fiscal Year	Name	Unit of Measure	Estimated Material Cost	Estimated Labor Costs	Total Costs
1	1970	Wiseman Spring	1 Each	$500.00	$500.00	$1000.00
2	1971	Broken Jug Spring	1 Each	500.00	500.00	1000.00
3	1971	Cottonwood Spring	1 Each	500.00	500.00	1000.00
4	1971	Gabiola Spring	1 Each	500.00	500.00	1000.00
5	1971	White Spring	1 Each	500.00	500.00	1000.00
6	1971	Black Hornet Spring	1 Each	500.00	500.00	1000.00
7	1971	Arrowrock Spring	1 Each	500.00	500.00	1000.00
8	1971	Unknown	1 Each	500.00	500.00	1000.00
9	1971	Unknown	1 Each	500.00	500.00	1000.00
10	1971	Unknown	1 Each	500.00	500.00	1000.00
11	1971	Unknown	1 Each	500.00	500.00	1000.00
12	1971	Highland Valley Fence	2 Mi.	2000.00	1000.00	3000.00
13	1971	Highland Valley Cattleguard	1 Each	1500.00	500.00	2000.00
				$9000.00	$7000.00	$16000.00

Alternate Plan:
Water will be hauled in areas.

Development Responsibility

Responsibility for development of proposed projects will be clearly defined prior to programming. Programming by BLM will be dependent upon available funds. Responsibility for labor, material and equipment costs will be worked out on each project approximately six months to one year before construction. Equipment for development will be furnished by BLM & Idaho Fish & Game upon request and supply. It must be remembered that the above listed projects may not be the total number needed since many springs not listed have been developed by the Fish & Game. Priorities are subject to change from time to time.

Maintenance Responsibilities

I. Maintenance Outside the Forest Boundary

The operators agree to maintain fences and springs that they have been maintaining prior to the initiation of this system, and also to perform the necessary routine maintenance on range improvements within the

pasture that is currently being used by the livestock. Additional range improvements such as fences, springs, cattleguards, etc., which are new to the operator's former operations will be maintained cooperatively by the agencies involved, namely Idaho Fish & Game Department, Idaho State Land Board, and the Bureau of Land Management.

II. Maintenance Within the Forest Boundary

The operators agree to maintain that portion of the Dead Dog Allotment Fence which is on the forest, to the satisfaction of the Forest Service prior to turning livestock on the allotment.

Licensing Procedures

Bureau of Land Management

At the end of the grazing season actual figures supplied by each operator will be utilized to compute the annual grazing bill. This will enable the operator to pay for exactly what he gets from BLM land. This licensing procedure will be placed in effect after the Rest Rotation System has been adopted.

Idaho Fish and Game

The Idaho Fish and Game Department will charge for the amount of livestock use on their lands over and above the amount of livestock use rested from the lands of the private landowners.

Forest Service

A temporary association-type permit will be issued to the users prior to use on any year the Dead Dog Allotment will be grazed. Payment of grazing fees will be in advance of use and will be at the rate presently in effect on the Boise National Forest.

EVALUATION PROCEDURES

The following special studies will be completed along with other general observations to evaluate the success of the management plan.

Trend - Two to three observation points will be established on key sites. The study method will be based on manual procedures adopted to District conditions (to be further defined in a District Instruction Memo).

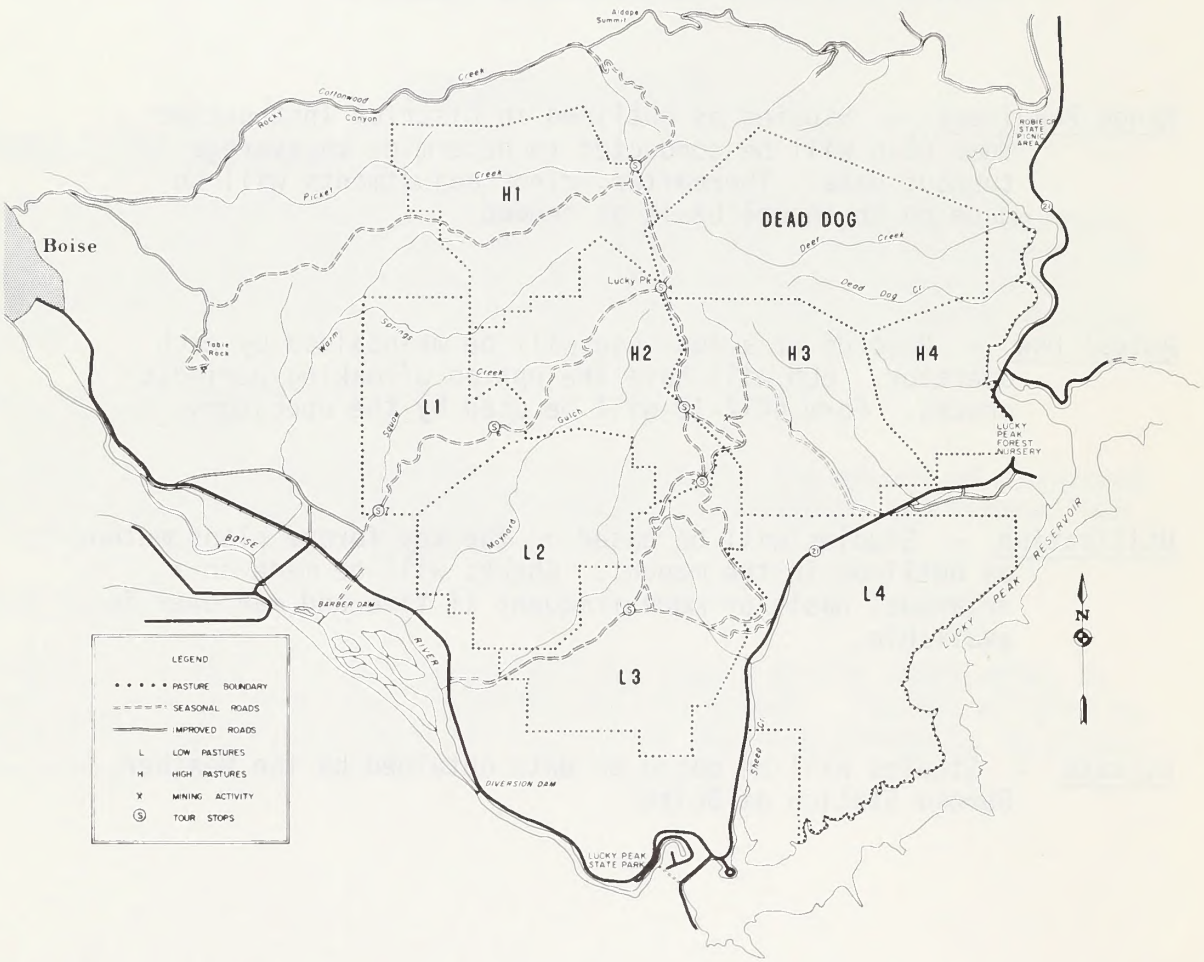
Range Readiness - Studies as outlined in District Instruction Memo 68-6 will be conducted to determine an average turnout date. Thereafter, minor adjustments will be made on an annual basis as needed.

Actual Use - Records of actual use will be maintained by each operator. BLM will have the option of making periodic checks. Form 4412-18 will be used by the operators.

Utilization - Studies will be based on the key forage plant method as outlined in the manual. Checks will be made on a triannual basis or more frequent if time and manpower is available.

Climate - Studies will be based on data obtained by the Weather Bureau Station at Boise.

LUCKY PEAK RESOURCE MANAGEMENT UNIT



Appendix II-A-1

Soil Erosion Condition Classification - By Vegetative Types

August, 1973 [1/]

Vegetation Type	Condition Class					Total Acreage In Sample
	Stable	Slight	Moderate	Critical	Severe	
Grass	19 [2/]	49	25	6	1	9,095,000
Meadow	54	18	18	0	0	91,000
Perennial Forbs	11	54	9	20	6	53,000
Sagebrush	11	49	34	5	1	38,924,000
Mountain Shrub	15	49	31	5	0	1,459,000
Conifer	40	30	23	6	1	1,871,000
Waste (2% cover)	8	22	31	24	15	1,039,000
Pinon-Juniper	3	36	46	14	1	14,204,000
Broadleaf Tree	67	18	13	2	0	160,000
Creosote	2	28	54	14	2	5,496,000
Mesquite	1	18	47	33	1	803,000
Saltbrush	5	40	40	14	1	8,242,000
Greasewood	8	33	40	18	1	2,742,000
Winterfat	6	57	33	4	-	602,000
Desert Shrub	6	42	41	10	1	8,617,000
Half Shrub	4	49	44	3	0	446,000
Annuals	35	43	13	9	0	873,000
Total Acreage						94,717,000

[1/] Source - Bureau of Land Management's Watershed Condition Classification Procedures.

[2/] Expressed as percent of sample.

Appendix II-A-1-a

Predicted Soil Erosion Condition Classification by Vegetative Type with Proper Management and Land Treatment Completed. 1/

Veg. Type	Condition Classes					Acreage in Sample 1,000 ac.
	Stable	Slight	Moderate	Critical	Severe	
Grass	45 2/	48	5	2	0	2,458
Meadow	93	7	0	0	0	31
Perennial Forb	No estimate					
Sagebrush	34	57 .56	8	0.4	0.04	12,160
Mountain Shrub	20	75	5	0	0	264
Conifer	66	28	5.7	0.3	0	286
Waste (> 2% cover)	1	8	30	48	13	212
Pinon-Juniper	10	64	21	4	1	4,787
Broadleaf Tree	No estimate					
Creosote	1	70	28	1	0	770
Mesquite	53	23	24	0	0	262
Saltbrush	16	66	15	2.6	0.4	1,923
Greasewood	17	58	21	4	0	919
Winterfat	16	81	3	0	0	335
Desert Shrub	14	64	21	1	0	2,843
Half Shrub	26	58	16	0	0	92
Annuals	83	14	3	0	0	221

1/ Source - Bureau of Land Management's Watershed Condition Classification Procedures.

2/ Expressed as percent of sample.

APPENDIX II-A-2
1964 RANGE CONDITION CLASSIFICATION
NATIONAL RESOURCE LANDS - BY STATE TOTALS
BASED ON USABLE ACRES

STATE	Range Condition Classification (Usable Federal Range)					
		Excellent	Good	Fair	Poor	Bad
ARIZONA	Percent	1	9	34	45	11
CALIFORNIA	Percent	1	14	63	21	1
COLORADO	Percent	1	11	55	29	4
IDAHO	Percent	2	20	55	21	4
MONTANA 1/	Percent	1	47	46	5	1
NEVADA	Percent	2	15	56	24	3
NEW MEXICO	Percent	4	19	68	8	1
OREGON 2/	Percent	1	9	45	32	13
UTAH	Percent	-	5	51	36	8
WYOMING	Percent	2	15	51	30	2

1/ Includes North Dakota and South Dakota

2/ Includes state of Washington

Soil Stability Class

I. Soil Wetness

(a) Seeps, springs and other areas where water is on top of the soil surface.
(b) Presence of hydrophytes. The hydrophytes must be defined locally.
(c) Meadows.
(d) Black soils. These types of soils must be defined locally as having high water tables, as many black soils are well drained.
(e) Soils that are gleyed and/or mottled.
(f) Small ponds of water located adjacent to an old slump escarpment (sag ponds).

Soil wetness is very important because water tends to "float" the soil mantle just as a person "floats" in a swimming pool. The soil mantle slides out of a wet area if a road cut removes the support just as water runs out of a swimming pool if a side is removed.

II. Areas Where Consolidated Bedrock is More Than Ten Feet Below the Soil Surface

(a) Fault Zones - Consolidated bedrock is ground and fractured by the faulting action.
(b) Pockets of colluvium that have accumulated from previous erosion processes.
(c) Any type of rock that is composed of hard fragments cemented by a finer grained matrix and the matrix is weathering into clay minerals.

(Examples of this situation would be conglomerates, agglomerates, tuffs, and breccias where the matrix has undergone considerable weathering.)

(d) Areas where the rock has weathered to great depths into soft materials that can be dug with a shovel.

Consolidated, continuous bedrock close to the surface provides a sound foundation to support the soil mantle above an area of disturbance. Fractured weather or deep bedrock does not provide support once the area is disturbed. Consequently, the soil mantle slides down the hillside. Cohesionless types of soil pose the highest hazard for landsliding on areas described in this category.

III. Areas Where the Soil Mantle is Presently Sliding

(a) Tension cracks. This is where the soil mantle has cracked open as soil moves downhill away from soil that has stayed in place.

(b) Hummocky hillsides. Usually occurs in plastic soils that are slowly moving downhill.

(c) "Jackstrawed" or "crazy" trees. Trees tilted at different angles while having a straight trunk denotes very recent soil movement.

(d) Curved tree butts. The soil mantle has slid slowly during the life time of the tree.

(e) Depressions resulting from the withdrawal of material downslope.

Present sliding, as denoted by above clues, will be accelerated if the soil mantle is disturbed. Most of the time, clues listed under I and II will be found in conjunction of those listed in III.

The headwalls of drainages are usually oversteened by natural erosion processes. These areas are very prone to mass soil wasting if they are disturbed. The headwall is that portion of a stream draw which has a very sharp increase in slope gradient from the toe of the mountain to the ridge top or saddle.

Soil Classifications

Soil Classification is the systematic arrangement of soils into classes in one or more categories or levels of classification for a specific objective. Broad groupings are made on the basis of general characteristics and subdivisions on the basis of more detailed differences in specific properties.

Order is the category at the highest level of generalization in the soil classification system. The properties selected to distinguish the orders are reflections of the degree of horizon (soil layer) development and the kinds of horizons present. The 10 orders are:

Alfisols - Soils with gray to brown surface layers that contain a good supply of bases and subsoils high in clay. These soils form primarily under forest or savannah vegetation with climates of slight to pronounced seasonal moisture deficit.

Aridisols (L. Aridus, Dry) - Soils characteristic of dry places with natural horizons low in organic matter and a definite moisture deficiency. They have light colored surface soils with distinct structure. These soils have developed in arid regions under sparse shrub vegetation.

Entisols (Recent Soils) - Soils which have no distinguishable natural horizons. They may be found in practically all climate regions on recent geomorphic surfaces, either on steep slopes that are undergoing active erosion or on fans and flood plains where the recently eroded materials are deposited.

Histosols (Gk. Histos, Tissue) - Soil formed from organic soil materials.

Inceptisols (L. Inceptum, Beginning) - Soils that are usually moist with natural horizons, thought to form rather quickly from altered parent materials, but not by accumulation. Generally, soil development is not evident from the soil-forming processes. These soils are found under deciduous forests in temperate humid regions and also under wet or poorly drained conditions.

Mollisols (L. Mollis, Soft) - Soils characterized by nearly black, organic-rich surface horizons with high natural fertility. These soils have an accumulation of relatively large amounts of organic matter and have good structural properties. These soils are formed in a cool sub-humid to a warm, semiarid climate under varying vegetative types including deciduous forests, grasslands, halophytic plants, etc.

Oxisols (F. Oxide, Oxide) - Soils of tropical and subtropical regions characterized by extreme weathering which results in an accumulation of inactive clays, oxides or iron and aluminum and quartz. These soils are formed under humid, forested conditions.

Spodosols (GK. Spodos, Wood Ash) - Soils with subsurface horizons containing an accumulation of organic matter and compounds of aluminum and iron. These soils are formed in acid coarse-textured materials in humid and cool or temperate climates under coniferous or mixed coniferous and deciduous forests.

Utisols (L. Ultimus, Last) - Soils of humid tropical areas characterized by subsurface horizons of clay accumulation or a cemented layer (fragipan). They are low in natural fertility due to a loss of bases through weathering and removal by leaching. These soils formed under wet-dry seasons and tropical forest vegetation.

Vertisols (L. Verto, Turn) - Clayey soils with high shrink-swell potential that have wide, deep cracks when dry. These soils have developed under widely varying climatic conditions, but usually with altering wet and dry seasons.

A comparison of the new soil classification system with approximate equivalents of the old system follows:

New (Order)	Old (Great Soil Groups)
1. Alfisols	Gray Brown Podzolic, Gray Wooded Soil, Non-Calcic Brown soils, Degraded Chernozem, and associated Planosols and some Half-Bog soils--Zonal order
2. Aridisols	Desert, Reddish Desert, Sierozem, Solonchak, some Brown and Reddish-Brown soils, and associated Solonetz--Zonal and Intrazonal orders
3. Entisols	Lithosols, Regosols and Alluvial soils with some Low-Humic Gley soils--Azonal and Intrazonal orders.
4. Histosols	Bog soils--Interzonal order
5. Inceptisols	Ando, Sol Brun Acide, some Brown Forest, Low-Humic Gley, and Humic Gley Soils--Zonal and Intrazonal orders.
6. Mollisols	Chestnut, Chernozem, Brunizem (Prairie, Renzina, some Brown, Brown Forest, and associated Solonetz and Humic Gley soils--Zonal and Intrazonal orders.

7.	Oxisols	Laterite soils, Latosols--Zonal order
8.	Spodosols	Podzols, Brown Podzolic soils, and Groundwater Podzols--Zonal and Intrazonal orders
9.	Ultisols	Red Yellow Podzolic soils, Reddish-Brown Lateritic soils, and associated Planosols and Half-Bog soils--Zonal and Intrazonal orders
10.	Vertisols	Grumusols (dark clay soils)--Intrazonal order

Appendix II-D

DESCRIPTION OF CHARACTERISTIC SOIL SERIES IN MAJOR BIOMES

Dominant or characteristic soils within the various biomes are described in detail in Appendices II-D-3 through II-D-11. These tables have been prepared for each biome or biological community except the subtropic community to assist those wishing to prepare more detailed analyses on specific areas. Some characteristics, uses, and limitations are given for each of the listed soil series. Specific items for each soil such as the unified classification of the subsoils for engineering uses and hydrologic groups are given as well as general information. Thus, the information may be used by engineers, hydrologists, and soil scientists as well as the general public to gain some knowledge of the soils. The listed soil series are not inclusive. They occur extensively in the region under which they are identified, but they must be viewed as examples. A detailed, on-site soil survey must be made before the total soil resource is known. More detailed information of the soils characteristics and limitations may be obtained from the soil survey reports listed in the selected references.

Definitions of Table Headings

Soil Name

Each soil series in the United States is given a name. The name identifies a specific soil just as names identify people. Soil names are correlated so that any one name applies only to a specific soil, regardless of occurrence.

Unified Classification (UC)

This is one of the two systems that classify soil material for engineering uses.

The unified soil classification system identifies soils according to their textural and plasticity qualities, and their grouping with respect to their performance as engineering construction materials. Soil materials are divided into 15 classes; eight classes are for coarse-grained material, six classes are for fine-grained material, and one class is for highly organic material. Soils that have characteristics of two classes are designated by symbols for both classes; for example, CL or ML. Each class is identified by a letter symbol. GP identifies poorly graded level and mixtures of gravel and sand with little or no fines. Soils in class SM are silty sands and mixtures of sand and silt. Soils in class ML are inorganic silts of low liquid limit that are mixed with sand and clay. Soils that are

predominantly silts and clays that have a low liquid limit are in class CL. The symbol CH identifies inorganic clays that have a high liquid limit and plasticity.

The first letter of the class symbol indicates the grain size, for example, G stands for gravel, S for sand, M for silt, C for clay, and O for organic. The odifying terms indicated by second letter are P for poorly graded, W for well graded, M for silty, and C for clayey. The symbol L stands for low liquid limit and H for high liquid limit.

Available Water Capacity (AWC)

Available water capacity refers to the total quantity of water available for plant growth that is stored in the effective root zone of the upper 60 inches of the soil profile at field capacity. It is largely dependent upon the effective depth, texture, structure, porosity, organic matter content, and coarse fragment content. In general, profiles that contain 50 percent coarse fragments by volume will only have one-half the moisture holding capacity of a comparable soil that is free of coarse fragments.

Hydrologic Groups (HG)

Soils are placed in hydrologic groups according to their potential to yield run-off. This information is used in watershed planning. Various hydrologic groups range from (A), that shed almost no precipitation to (D), that shed nearly all the precipitation.

A - Very deep, coarse and moderately coarse textured soils that transmit water through their profile and substratum at a high rate. These soils have the lowest run-off potential.

B - Medium to fine-textured, moderately deep to very deep soils having a moderate rate of water transmission through the profile.

C - Fine-textured, deep and very deep soils that have a slow rate of water transmission through the subsoil.

D - Fine-textured, deep soils, and impervious material exposed or covered by a thin mantle of soil. These soils have the highest run-off potential.

Relief

Relief is expressed as a range in the slope percentage that each soil may have.

Appendix II-D-1. Some Characteristics, Uses and Limitations of Dominant Soils Occurring in the Northern Temperate Grassland

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
WILLIAMS	Montana Dawson Co.	CL	12	B	1-8	Crops	Cropland
Limitations - Slight to moderate erosion hazard.							
CHERRY	Montana Dawson Co.	CL	10-14	C	0-25	Crops Grasses	Cropland Rangeland
Limitations - Slight to moderate erosion hazard, poor road fill material.							
FARGO	Montana, Judith, Basin Area	CH	--	D	0-3	Sedges & Rushes	Pasture
Limitations - Poorly chained, calcareous clays, high water table, severe compaction hazard, slight erosion hazard, soil management is very difficult.							
SLICKSPOTS	Sedwick Co. Colorado	ML	2-4	B	0-5	Winter Grains	Dryland farming
Limitations - Pan exists of about 15 inches, severe erosion hazard.							
DUNE LAND	Morgan Co. Colorado	SP	3-6	A	5-25	Sparse Grass	Limited grazing
Limitations - Dunes are actively blowing, very severe wind erosion hazard.							

Appendix II-D- 1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
BAINVILLE	Sterrk Co. N. Dakota	CL	2	C	3-40	Crops & Grass	Cropland, rangeland
Limitations - Severe wind and water erosion hazard, over clayey shale, low natural fertility.							
CRETE #1	Nebraska	CH	9-12	-	0-5	Row crops, hay & pasture short & reed grasses	Range, farming
Limitations - Moderate erosion hazard, high in fertility, high shrink-swell potential.							
TILLMAN #2	Texas	CL, CH	9-12	-	1-3	Short grasses small grains	Range cultivated crops
Limitations - High natural fertility, droughty, slight erosion hazard.							
BADLAND #2	Texas	--	--	D	2-12 to 20-75	Some short grasses	--
Limitations - This land supports little vegetation. It is thoroughly dissected by large gullies and by bald ridges and knobs; high erosion hazard.							
PORT #3	Oklahoma	ML. CL	6-9	C	nearly level	Small grains hay, orchards, pasture	Farming
Limitations - Flood plain, calcareous substratum, thick surface layers.							

Appendix II-D-1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
RICHFIELD #4	Kansas	CL, CH	9-12	C	3	Small grains, mature grasses	Dry farming, range

Limitations - Table land, well drained, susceptible to wind and water erosion, natural fertility is high.

#1 - USDA, SCS, Soil Survey, Gage County, Nebraska, 76 pp, Illustrated 1964.

#2 - USDA, SCS, Soil Survey, Foard County, Texas, 71 pp, Illustrated 1964.

#3 - USDA, SCS, Soil Survey, Comanche County, Oklahoma, 58 pp, Illustrated 1967.

#4 - USDA, SCS, Soil Survey, Wichita County, Kansas, 63 pp, Illustrated 1965.

Appendix II-D-1 (Continued)

Some Characteristics, Uses and Limitations of Dominant Soils Occurring in the Southern Temperate Grassland

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
REEVES #2	Texas	CL	3-6	C	0-20	Desert shrub, salt tolerant grasses	Range
Limitations - Salinity, high corrosion potential, calcareous outwash, gypsum in the subsoil.							
BREWSTER #3	Texas	GC, GM	0-3	D	6-60	Short grasses, mid grasses, desert shrub	Range wildlife, recreation
Limitations - Bedrock within 20 inches, stony.							
GOLIAD #3	Texas	CL	3-6	C	0-12	Short and mid grasses	Range, crops, wildlife
Limitations - High shrink-swell potential, severe building foundations problems, high corrosion potential, shallow to moderate depths over caliche.							
ECTOR #2	Texas	CL	0-3	D	0-3	Short & mid grasses	Range, crops, wildlife, recreation
Limitations - Bedrock or cemented caliche within 20 inch depth, stoniness, moderate, shrink-swell potential, high erosion hazard.							

Department of Ag. Communications, Texas A&M University, General Soil Map of Texas.
#2 - USDA, SCS, Soil Survey, Howard County, Texas, 68 pp, Illustrated 1969.
#3 - USDA, SCS, Unpublished Soil Descriptions.

Appendix II-D-1 (Continued)

Some Characteristics, Uses and Limitations of Dominant Soils Occurring in the Palouse Prairie Grassland

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
CONDON	Oregon	CL	3-6	C	0-35	bb wheat, I fescue	Range, dry farmland
Limitations - Wind erosion hazard is medium to high.							
WALLA WALLA #1	Oregon	CL	6-9	B	0-35	bb wheat, I fescue	Range, dry farmland
Limitations - Wind erosion hazard is medium to high.							
WUNTHERN #1	Oregon	SM, ML	6-9	C	35-70	Idahofescue	Range
Limitations - Somewhat excessively drained, stony or rock north facing soil erosion hazard is severe, fertility is moderate.							
LICKSKILLET #1	Oregon	CL	2-5	D	7-70	bb wheat	Range
Limitations - Very to extremely stony, south facing uplands, natural fertility is low.							
QUINCY #2	Washington	SP	0-3	A	0-30	Sagebrush, grassland	Range
Limitations - Excessively drained soils in dunes, severe wind erosion hazard.							

#1 - USDA, SCS, Soil Survey, Sherman County, Oregon, pp 104, Illustrated 1964.
#2 - USDA, SCS, Soil Survey, Benton County, Washington, pp 72, 1971.

Appendix II-D-1 (Continued)

Some Characteristics, Uses and Limitations of Dominant Soils Occurring in the California Prairie Grassland

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
MERCED	California	CH, ML	12+	C/D	0-3	Crop plants, annual grasses	Row crops
Limitations - Fine textured alluvium, most has been made land, alkaline and saline, pumping is done to remove water from soil.							
FRESNO	California	ML, CL	12+	C/D	0-3	Natural range	Field crops, irrigated pasture
Limitations - Sandy alluvium, saline-alkalin, difficult to establish vegetative cover, high water table.							
HANFORD	California	ML, SM	9-12	B	0-3	Vegetable crops, etc.	Cultivated, irrigated
Limitations - Sandy alluvium, water table 30-75 feet.							
POSITAS	California	CH	1-4	D	0-30	Annual grasses and forbs	Pasture or range
Limitations - Gravelly, cobbly alluvium, water supplies are short, high erosion hazard.							

Appendix II-D-1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
VISTA	California	SM	1-4	C	3-70	Annual grasses and forbs	Range
Limitations - Shallow to moderately deep upland soils, water supply is limited, high erosion hazard.							
CIBO	California	CH	5-8	D	3-70	Annual grasses and forbs	Range
Limitations - Clayey soils over igneous rock outcrops are common, water sources are limited.							
AUBERRY	California	SC	5-8	D	3-70	Trees, grasses, and shrubs	Range, dry farmed, grain
Limitations - Moderately coarse textured soils on upper foothills, rock outcrops are common, erosion is moderate to severe.							

USDA, SCS, Soil Survey, Eastern Fresno Area, California, pp 323, 1971.

Appendix II-D-1 (Continued)

Some Characteristics, Uses, and Limitations of Dominant Soils Occurring in the Hot Desert

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
ANTHONY #1	Arizona	SM	9-12	-	0-5	Annual grasses, shrubs and cacti	Range, irrigated crops, urban development
Limitations - Alkaline and calcareous throughout, moderately rapid permeability.							
MOHAVE #1	Arizona	CL	9-11	-	0-3	Annual grasses, desert shrubs	Desert range, irrigated crops, urban development, wildlife
Limitations - Calcareous throughout.							
CAIRE #2	Arizona	SM	0-3	-	0-30	Annual grasses, desert shrubs	Range, wildlife
Limitations - Calcareous, gravelly over a hardpan, natural fertility is low.							

Appendix II-D-1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
CIONEHA #3	California	SM, GM	0-3	C	5-30	Annual grasses, small grains	Range, dryland farming, pasture, homesites
Limitations - Somewhat excessively drained upland soils, high erosion hazard, tapid permeability.							
CHINO #3	California	CL	9-11	B-C	0-2	Annual grasses, weeds, small grains, grasses and legumes	Hay, pasture, dryland grain, homesites
Limitations - Somewhat poorly drained to poorly drained floodplains, saline-alkali soils, slight erosion hazard, can be drained to improve salt content.							
ROCKLAND #3	California	--	0-3	D	15-75	Annual grasses,	Wildlife
Limitations - Granite boulders and rock outcrops that cover 35 to 60 percent or more of the surface, high erosion hazard.							

#1 - USDA, SCS, Soil Survey, Tucson-Avra Valley Area, Arizona, pp 70, Illustrated, 1972.
#2 - USDA, SCS, Soil Survey, Safford Area, Arizona, pp 57, Illustrated, 1970.
#3 - USDA, SCS, Soil Survey, Western Riverside Area, California, pp 159, Illustrated, 1971.

Appendix II-D-1 (Continued)

Characteristics, Uses and Limitations of Dominant Soils Occurring in the Cold Desert

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
BILLINGS	Utah	ML	6-10	C	0-10	Range, irrigated crops and grasses	Range, cropland
KENILWORTH	Utah	SM	3-5	B	0-20	Juniper-pinon	Range
Limitations - Shallow, droughty, calcareous, reseeding hazard, moderate erosion hazard, stony soil.							
JEKLEY	New Mexico	CL	2-6	C	3-40	Pine-grass	Forest, range
Limitations - Moderate to severe erosion hazard, shallow soil, cold soil temperatures, high fertility.							
HUMBOLT #1	Nevada	MH	9-12	D	0-3	Salt tolerant shrubs and grasses, irrigated crops	Irrigated crops
Limitations - Imperfectly drained along streams and shallow lakes, saline and alkali, slight erosion hazard.							

Appendix II-D-1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
QUINCY #1	Nevada	SP	0-3	A	3-12	Greasewood, rabbit brush, Indian grass	Range, some vegetation
Limitations - Excessively drained, wind blows verticals, rapid infiltration, natural fertility very low, severe erosion hazard, wind and water.							
PLACERITOS #1	Nevada	ML	9-12	C	0-3	Greasewood, saltbrush	Range, irrigated crops
Limitations - Imperfectly drained in alluvium, saline-alkali sacts, water table four to six feet, slight erosion hazard.							
VOLTAIRE #2	Nevada	CH, MH	9-12	D	0-3	Saltgrass, sedges, fescue	Pasture, hay, and grains
Limitations - Poorly drained in clay alluvium, fluctuating water table 20 to 36 inches, natural fertility is high.							
MOTTSVILLE	Nevada	SW, SM	3-6	A	3-45	Big sage, bitterbrush	Grazing
Limitations - Excessively drained, alluvial faces, erosion hazard slight to moderate, susceptible to wind erosion, natural fertility is low.							

Appendix II-D-1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capaicty (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
BAKEOVEN #3	Idaho	ML, CL	0-3	D	0-80	Big sage, sandberg bluegrass	Grazing
Limitations - Very shallow sacts on basalt, erosion hazard severe on steeper slopes, very strong throughout.							
GEM #3	Idaho	CH, MH	6-9	C	0-60	Big sage, bb wheat	Dryfarmed, irrigated, range
Limitations - $CaCo_3$ below 15 feet, slight to severe erosion hazard.							
DESCHUTES #4	Oregon	SM	3-6	C	0-20	Juniper, grassland	Range, irrigation, homesites
Limitations - Somewhat excessively drained, high terraces, wind erosion is high, natural fertility is low.							
DAY #4	Oregon	CH	3-6	D	6-40	Big sage, bb wheat	Range
Limitations - High shrink-swell, cracks when dry, high water erosion hazard.							

Appendix II-D-1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
SALISBURY #4	Oregon	CL	3-6	D	0-20	Big sage, Idaho fescue, bb wheat	Range dry farmed, small grains

Limitations - Well drained soils with silic-cemented pan, stony soils.

#1 - USDA, SCS, Soil Survey, Lovelock Area, Nevada, pp 87, Illustrated, 1965.

#2 - USDA, SCS, Soil Survey, Carson Valley Area, Nevada, pp 129, Illustrated, 1971.

#3 - USDA, SCS, Soil Survey, Gem County, Idaho, pp 188, Illustrated, 1965.

#4 - USDA, SCS, Soil Survey, Prineville Area, Oregon, pp 89, Illustrated, 1966.

Appendix II-D-1 (Continued)

Some Characteristics, Uses and Limitations of Dominant Soils Occurring in the Woodland-Bushland Biome

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
ARNOLD #1	California	SP, SM	3-5	A	9-50	Annual grasses and shrubs	Range
Limitations - Somewhat excessively drained sandy soils over soft sandstone, erosion hazard is moderate to severe, low fertility.							
CAMARILLO #1	California	SM	7-9	C	0-2	Salt tolerant grasses and shrubs	Vegetables, lemons, & homesites
Limitations - Poorly drained sandy soils, where not drained water table is at two feet, subject to flooding, high fertility.							
DIABLO #1	California	CL	6-9	D	9-50	Annual grasses and oak	Range
Limitations - Well drained clays in shale uplands, erosion hazard moderate to severe, high shrink-swell potential.							
GAVIOTA #1	California	SM	0.5-1	D	15-50	Annual grasses, brush and oaks	Range
Limitations - Shallow well drained sandy soils over sandstone, erosion hazard is moderate to severe. Inherent fertility is low.							

Appendix II-D-1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
GAZOS #1	California	GM	3-6	C	15-75	Brush and annual grasses	Range and homesites
Limitations - Silty soils over fractured shale, erosion hazard is severe, natural fertility is high.							
LOS OSOS #1	California	CL	4-8	C	9-50	Annual grasses, forbs, birch, oak	Range, citrus field crops, homesites
Limitations - Clayey soils over shale, erosion hazard is severe, natural fertility is high.							
MOCHO #1	California	ML, CL	8-10	B/C	0-9	Annual grasses, forbs	Row crops, orchards, field crops, homesites
Limitations - Well drained loams on fans, no erosion hazard, fertility is medium.							

Appendix II-D-1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
SALINAS #1	California	CL, ML	10-11	C	0-9	Annual grasses, forbs	Row crops, field crops, orchards, range, homesites
Limitations - Clayey soils on plains, no erosion hazard, high in fertility.							
SANTA LUCIA #1	California	GC	3-5	C	15-75	Annual grasses, and brush	Orchards, range, homesites
Limitations - Shaley uplands, erosion hazard is moderate to severe. Inherent fertility is moderate.							
TULLHOWSE #2	California	SM	1-2	D	5-65	Scrub oak, brush and annual grasses	Range recreation
Limitations - Excessively drained shallow sandy soils from granite, erosion hazard moderate to high, fertility is low.							

Appendix II-D-1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
LAS POSAS #2	California	CH	4-6	C	2-65	Chaparral-oak, annual grasses	Field crops, row crops, orchards, range
Limitations - Sandy soils from basic igneous rocks, fertility is medium, erosion hazard is high to very high.							
BOOMER #2	California	CL	7-10	B	15-75	Conifer forest, deciduous	Wood products
Limitations - Loams over metamophosed uplands, erosion hazard is very high, fertility is moderate.							

#1 - USDA, SCS. Soil Survey, Ventura Area, California, pp 148, Illustrated, 1970.

#2 - USDA, SCS, Soil Survey, San Diego Area, California, Draft Manuscript, Portland, Oregon.

Appendix II-D-1 (Continued)

Some Characteristics, Uses and Limitations of Dominant Soils Occurring in the Montane Coniferous Forest

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
JUGHANDLE #1	Idaho	GM	6-9	B	12-65	Conifer forest, forage	Wood products, summer range
Limitations - Somewhat excessively drained, erosion hazard is severe to very severe, fertility is moderate to low.							
KLICKER #1	Idaho	GC	6-9	C	12-65	Conifer forest, forage	Wood products, summer range
Limitations - Erosion hazard severe to very severe, moderate fertility.							
MARIPOSA #2	California	ML, CL	0-3	C	9-85	Conifer forest	Wood products, range
Limitations - Shallow, rocky uplands, erosion hazard is very severe.							
JOSEPHINE #2	California	ML	6-9	B	3-71	Conifer forest, hardwood, brush	Wood products, range
Limitations - Gravelly or rocky soils, fertility is moderate, erosion hazard is moderate to severe.							

Appendix II-D-1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
AUBURN #2	California	ML, CL	3-6	C	3-71	Grass, oak, brush	Range, dry farmed, hay and grain
Limitations - Shallow foothills, moderate fertility, erosion hazard is moderate to very severe.							
WOODSIDE #3	Montana	SM, ML	3-6	A	5-35	Conifer forest	Wood products
Limitations - Somewhat excessively drained footslopes and terminal moraines, low natural fertility, erosion hazard is high.							
SLOCUM #3	Montana	ML	9-12	B	0-3	Deciduous forest and grasses	Pasture, hay, small grains
Limitations - Imperfectly to moderately well drained fans and terraces, most areas are sub-irrigated. Imperfectly drained areas are saline.							
STEEUM #4	Colorado	ML	0-3	D	0-70	Pinon-juniper, grasses	Range, watershed
Limitations - Erosion hazard is very high, rock outcrops are common, 20 to 40 percent gravel content, moderately low fertility, droughty soils.							

Appendix II-D-1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
BROLLIAS #5	Arizona	CH	6-9	-	0-30	Pine-grass	Wood products, summer range
Limitations - Hilly uplands, 20 to 60 percent surface stones and cobbles, erosion hazard low.							
SPUNGELVILLA #5	Arizona	CH	6-9	D	0-20	Pine-juniper	Range
Limitations - High shrink-swell potential, cracks when dry, 30 to 50 percent surface stones, erosion hazard is moderate.							
ROCKSLIDES #6	Colorado	GP	--	A	10-100	Spruce, alpine fields, mostly barren	Recreation
Limitations - Accumulations of loam rocks from landslides, some slides are stable, some slides near faces of cliffs are unstable, no erosion hazard, springs are common at the toe slope.							

#1 - USDA, SCS, Soil Survey, Kooskia Area, Idaho, pp 96, Illustrated, 1971.
#2 - USDA, SCS, Soil Survey, Amador Area, California, pp 160, Illustrated, 1965.
#3 - USDA, SCS, Soil Survey, Bitterroot Valley Area, Montana, pp 128, Illustrated, 1959.
#4 - USDA, SCS, Soil Survey, Trout Creek Watershed, Colorado, pp 48, Illustrated, 1961.
#5 - USDA, SCS, Soil Survey, Beaver Creek Area, Arizona, pp 75, Illustrated, 1967.
#6 - USDA, SCS, Soil Survey, Fraser Alpine Area, Colorado, pp 47, Illustrated, 1962.

Appendix II-D-1 (Continued)

Some Charactertistics, Uses and Limitations of Dominant Soils Occurring in the Northwest Coastal Coniferous Forest

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
HUGO #1	California	SC	4-8	B	6-60	Conifer forests, shrubs, grasses, and forbs	Forestry
Limitations - Very gravelly soils, very high erosion hazard.							
CLEAR LAKE #1	California	CH	8-10	D	0-3	Grasses, shrubs, and forbs	Hay, grain, orchards
Limitations - Shrink-swell potential is high, three to five feet to seasonal water table, surface cracks when dry, runoff is slow until surface is sealed then it is rapid, drainage improves productivity.							
YOLO #1	California	ML, CL	9-12	B	0-3	Annual and perennial crops	Cultivated crops & orchards
Limitations - Subject to flooding, well drained.							
ORFORD #2	Oregon	MH	9-12	C	3-60	Conifer forest	Woodcrops
Limitations - Severe erosion hazard.							
ACTIVE DUNE-LAND #2	Oregon	SP, SM	--	-	3-40	None	Recreation
Limitations - Unstable and subject to severe soil blowing, droughty, vegetation is difficult to establish.							

Appendix II-D-1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
HEMBRE #3	Oregon	ML	9-12	B	12-60	Conifer forest	Wood products
Limitations - High erosion hazard in cut banks, highly productive, stable mantles.							
NEHALEM #3	Oregon	ML, CL	12	B	3-12	Grass & legumes	Pasture
Limitations - Alluvial bottoms, subject to flooding.							
AMITY #4	Oregon	ML, CL	9-12	C	0-3	Annual and perennial grasses	Pasture, grains, & seeds
Limitations - Somewhat poorly drained terraces, compaction potential is high, water table.							
KINNEY #4	Oregon	ML	5-9	B	3-60	Conifer forest	Wood products
Limitations - Well drained uplands, unstable on steep slopes, erosion hazard high on steep slopes, subject to frost heaving.							
CINEBAR #5	Washington	ML	12+	B	3-60	Conifer forests, annual and perennial grasses & legumes	Hay, pasture, & wood products
Limitations - Well drained, terrace, erosion hazard on sutslopes and compacted areas are high.							

Appendix II-D-1 (Continued)

Soil Name	Location	Unified Classification	Available Water Capacity (inches)	Hydrologic Group	Relief (%)	Vegetation	Major Use
PUYALLUP #5	Washington	SM	6-9	B	0-3	Row crops, hay, pasture, and orchards	Farming
GROVE #6	Washington	GP, GM	3-6	A	3-60	Conifer forest	Wood products, feed crops, homesites

Limitations - Glacial outwash plains, gravelly soils, soils are droughty and low in fertility.

#1 - USDA, FS & SCS, Soil Survey, Sonoma County, California, pp 188, Illustrated, 1972.

#2 - USDA, SCS, Soil Survey, Curry Area, Oregon, pp 69, Illustrated, 1970.

#3 - USDA, SCS, Soil Survey, Tillimook Area, Oregon, pp 75, Illustrated, 1969.

#4 - USDA, SCS. Soil Survey, Marion County, Oregon, pp 132, Illustrated, 1972.

#5 - USDA, SCS, Soil Survey, Clark County, Washington, pp 113, Illustrated, 1972.

#6 - USDA, SCS, Soil Survey, Mason County, Washington, pp 76, Illustrated, 1960.

RURAL DEPENDENCY ON FORAGE SUPPLIED FROM NRL

Measures of income and related population change at regional and biome levels indicate economic impact, but do not express fully the dependency of rural areas on livestock related agriculture and the role of NRL forage production. This is because heavily populated counties tend to dominate the income statistics of the regions of which they are a part. On the other hand, a selection of individual counties could be misleading and an analysis of income flows for all counties is beyond the scope of this statement. However, some additional perspective can be gained by classifying counties according to certain characteristics.

Three separate indicators are used and the 413 western counties are classified under each. The three indicators are:

1. the dollar value relationship of beef cattle sales to total agricultural sales in each county;

2. an inventory number of beef cattle in each county; and

3. the relationship of forage produced on NRL to total forage consumed in each county.

Table II-E-1 summarizes county classification by indicator. Beef cattle sales dominate the agricultural sector in approximately 47 percent of the counties. NRL makes some contribution to livestock feed in 57 percent of the counties, although the degree of the contribution is open to interpretation.

Another way of looking at the same information is to array the 413 counties, from highest to lowest, under each indicator and partition the arrays into quartiles (fourths), thereby looking at the indicator characteristic for the top 25 percent, upper half, etc. For example, arraying the counties according to the importance of beef cattle sales to total agricultural sales shows that among the upper 25 percent (104 counties) the percent of cattle sales ranges from a high of 98 percent to 68 percent; half of the western counties have beef cattle sales accounting for at least 45 percent of total agricultural sales. Looking at the contribution of NRL forage to total forage consumed, the array falls off much more rapidly with the greatest impact clearly being in the first quartile. Table II-E-2 summarizes all quartiles for each indicator.

Choosing a somewhat arbitrary cutoff of 10 percent NRL forage contribution as being significant, Figure II-E-1 delineates areas where the livestock industry is relatively dependent on NRL as a significant source of raw material input. The broad lines enclose areas where NRL provide 10 percent or more of the feed consumed by beef cattle and sheep. The reader will quickly see the close correlation between the areas of Figure II-E-1 and the biomes described in Section II. The principal contribution of

NRL to rural area economies via the livestock industry is in the cold desert biome, the Southern Grasslands, portions of the Northern Grasslands and transition zones from desert to mountain in Idaho and New Mexico.

Table II-E-1: Indicators of Importance of Livestock and NRL Forage Supplies to Local (County) areas, 1970.

Counties where beef cattle sales to total agricultural sales are:

	75-100%	50-74%	25-49%	0-24%
No. Counties	67	126	108	112

Counties where number of beef cattle are:

	100,000 or more	50,000 -- 99,999	25,000 -- 49,999	10,000 -- 24,999	Less Than 10,000
No. Counties	32	90	127	89	75

Counties where NRL AUM's to total cattle and sheep AUM's are:

	50-100%	20-49%	10-19%	1-9%	Less than 1%
No. Counties	4	41	31	159	178

Table II-E-2: Results of Arraying Counties by Each Importance Indicator with Indicator Measures by Quartile, 1970.

	Range of Indicator by Quartile			
Indicator	I	II	III	IV
Beef cattle sales as percent of Total Agr. Sales:	98-68%	67-45%	44-23%	22-0%
Number of beef cattle:	507,400-55,700	55,600-25,600	25,500-14,200	14,000-0
NRL AUM's as percent of Total AUM's Consumed:	83-6%	6-1%	1-0%	0%

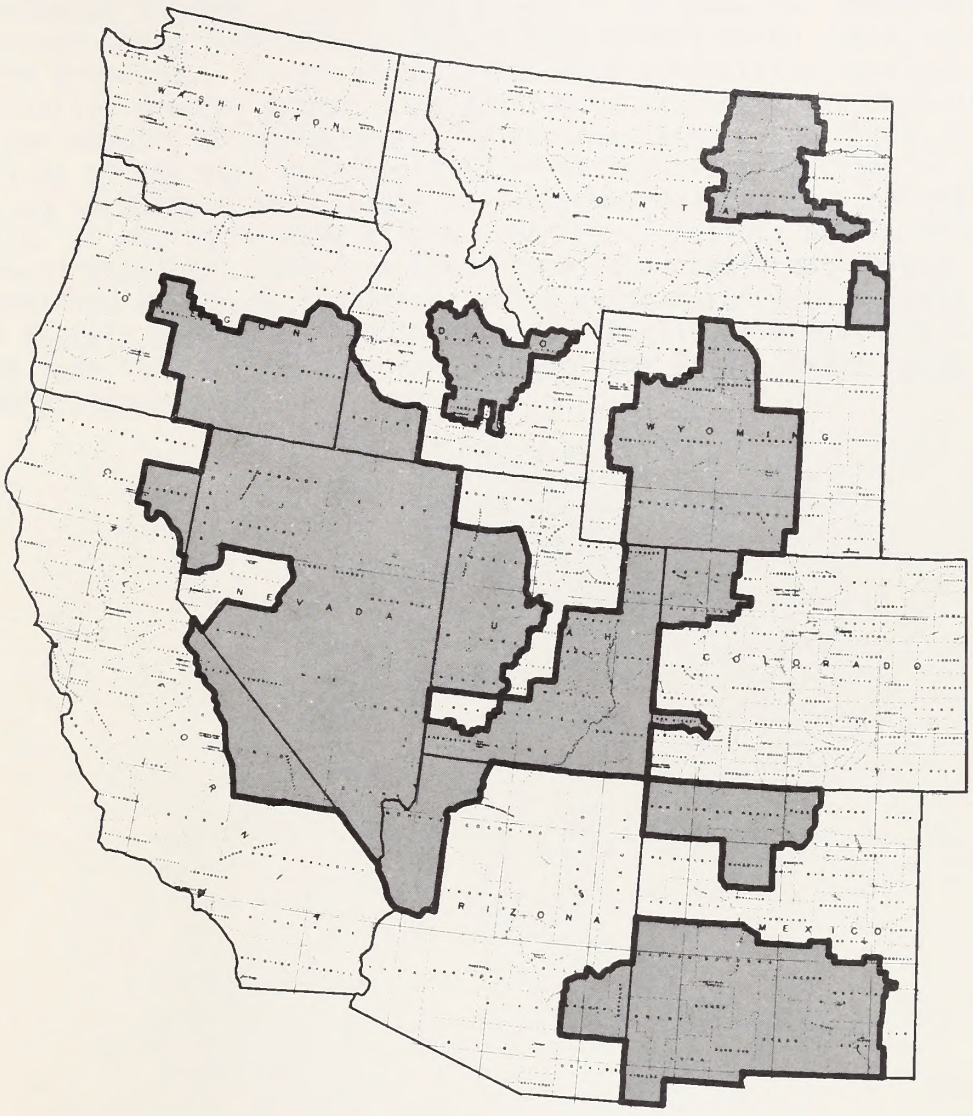


FIGURE II-E-1 AREAS WHERE TEN PERCENT OR MORE OF LIVESTOCK FORAGE IS SUPPLIED BY THE NRL. 1970.

URBAN TRENDS IN THE WEST

Throughout the West, as in most areas of the country, there has been a marked trend from 1960 to 1970 toward urbanization characterized by three processes. First, urban areas have essentially retained their own population growth; second, immigration to western areas from other parts of the country has been generally to urban areas; and third, rural populations of the West have declined by either becoming urban or by persons moving to urban areas. Table II-F-1 summarizes the urban-rural characteristics of regions within biomes. Of the 22 regions named, only four have a rural majority. Only one biome type, the coniferous forest, can be identified as having conditions which sustain rural population growth. The overall population growth rate for the 11 western states was 24 percent from 1960 to 1970; as can be seen from Table II-F-1, most of this growth occurred in urban areas.

TABLE II-F-1. 1970 Population and Urban-Rural Growth Trends by Biome and Livestock Region

Biome and Livestock Region	1970 Population	% Urban	% Change 1960-1970 Urban	% Change 1960-1970 Rural
Grassland Biome:				
N.W. Prairie	963,916	61	7	0
Calif. Cent. Valley	2,597,403	75	37	-15
Spring Wheat (NE Mont.)	74,840	29	-23	-18
Mont. Great Plain	182,653	59	8	-10
Wyo. Great Plain	181,095	64	4	- 8
Colo. Great Plain	1,455,175	86	26	-12
N.M. Great Plain	186,088	63	15	-13
So. Grassland	362,218	71	12	-21
Desert Biome: a/				
Snake River	470,485	59	22	- 8
Cold Des. (G. Bsn.)	1,045,270	76	31	- 2
Cold Des. (Cent.)	677,039	63	13	13
Cold. Des. (Wyo.)	147,708	60	11	-13
Hot Desert	2,995,880	86	60	-10
Woodland-Bushland (Part):				
Calif. Cent. Coast	5,145,524	93	34	-21
Calif. So. Coast	10,451,069	98	31	-26
Coniferous Forest:				
N.W. Forest	4,595,838	72	32	3
Sierra Range	293,271	34	49	26
Ariz-N.M. Mtns.	95,198	42	17	13
Colo.-N.M. Mtns.	788,245	60	64	15
Utah Mtns.	359,808	75	22	3
Mont.-Wyo. Mtns.	446,990	54	13	5
Id.-Ore. Mtns.	221,652	34	14	- 3
TOTAL	33,737,365	83	32	- 5

a/ Includes approximately 30 million acres of woodland-bushland.

Social Aspect of Livestock Grazing on NRL

Throughout the West a rural-ranching ethic has persisted over time as a factor in social and community relationships. This dimension of livestock grazing management is principally individual related. Table II-G-1 shows the distribution of individual permittees by size of permit. This data suggests that in terms of people, the social aspects of grazing management on NRL may play a noticeable role in community relationships and stabilization of noneconomic values.

Table II-G-1: Number of Permittees and AUM's by Size of Permit for Section 3 Lands, 1967

Permit Size AUM's	Permittees 1/ No.	%	Total AUM's 2/ No.	%	Avg. No. AUM's Per Operator 3/
0-99	3,850	26.7	46,509	0.4	12
100-499	5,342	37.0	802,277	6.9	150
500-999	2,013	14.0	848,786	7.3	422
1,000-1,999	1,586	11.0	1,430,145	12.3	902
2,000-2,999	645	4.5	1,325,500	11.4	2,055
3,000-3,999	316	2.2	1,220,856	10.5	3,863
4,000-4,999	199	1.4	755,768	6.5	3,797
5,000-14,999	398	2.8	3,069,580	26.4	7,713
15,000-24,999	48	0.3	1,372,000	11.8	28,583
25,000+	23	0.2	744,140	6.4	23,354
TOTALS	14,420	100.0*	11,615,561	100.0*	xxxxxx
AVERAGE	xxxx		xxxxx		806

*May not total due to rounding.

1/ 1967 Grazing Year, does not include free use, exchange of use and crossing permits.

2/ Computed on basis of all animals over 6 months of age equal 1.0 animal unit equivalent.

3/ Average number of AUM's grazed in 1966 does not always agree with permit size shown in Column 1.

Source: 1966 Cooperative Grazing Fee Survey, Statistical Reporting Service with USFS and BLM.

The relationship of each individual to a community is unique, yet the interrelationship of social groups is in fact the fabric from which community patterns are identified. Each community, in turn, has a set of characteristics which are partially shared and partially separate from other communities.

Within this context, the rancher plays a variety of roles in community structures depending upon his personal goals and background and upon the cultural trends of the community resulting from total social group interrelationships. Hence, in many rural communities throughout the West the cultural heritage of residents is inextricably linked to ranching and livestock production. In other areas, a "ranch-culture" has been modified or is in the process of change due to an influx of persons with different cultural backgrounds. Still other areas of the West were culturally developed around different focal points such as mining, trade centers or ethnic factors.

Ranching and livestock production often takes place in or around all types of communities. The relationship of ranching and ranchers to communities consequently differs from area to area. In some areas, ranching continues in its traditional role of community support; in others it is being overshadowed by new activities. In some areas, persons with non-ranch backgrounds are being drawn into ranching for personal reasons (be they economic or shared value systems) as a means toward goal fulfillment.

Ranching can be a full-time occupation or it can be part-time. In the latter case, rural communities provide jobs for ranchers who otherwise would have to sell out and find full-time employment elsewhere. Non-rancher residents of rural communities can, and often do, identify with a ranch ethic, thus deriving personal satisfaction from association and participation in community structures which include ranch and livestock operations.

Community relationships are too complex and varied to specify with any precision the social dependency on the role played by NRL, in a manner applicable throughout the 11 Western States. However, commitment of private lands for extensive uses, such as grazing, will surely diminish with time. Consequently, the social value of grazing on NRL can be expected to increase to whatever extent a ranch-ethic is valued in the future.

INFORMATION BULLETIN NO. 5

The Taylor Grazing Act

Bureau of Land Management • U.S. DEPARTMENT OF THE INTERIOR

The Taylor Grazing Act of June 28, 1934, with amendments to May 1, 1967, is the basic legislative authority governing the management and protection of the vacant public lands of the United States. Because of the broad powers it confers upon the Department of the Interior for multiple-use management of natural resources, it is one of the major conservation laws of the Nation. Without departing from the original primary objectives and conservation policies, the Congress has from time to time amended the Act to keep it abreast with changing demands.

Additional information concerning the administration of the Act can be obtained from the State offices listed in the back of this pamphlet, or by writing the Director, Bureau of Land Management, Washington, D. C. 20240.

BUREAU OF LAND MANAGEMENT

THE TAYLOR GRAZING ACT

AS AMENDED AND SUPPLEMENTED

An Act

To stop injury to the public grazing lands by preventing overgrazing and soil deterioration; to provide for their orderly use, improvement, and development; to stabilize the livestock industry dependent upon the public range; and for other purposes. Approved June 28, 1934 (48 Stat. 1269), as amended June 26, 1936 (49 Stat. 1976), July 14, 1939 (53 Stat. 1002), July 30, 1947 (61 Stat. 630), August 6, 1947 (61 Stat. 790), June 19, 1948 (62 Stat. 533), and May 28, 1954 (68 Stat. 151).

BE IT ENACTED BY THE SENATE AND HOUSE OF REPRESENTATIVES OF THE UNITED STATES OF AMERICA IN CONGRESS ASSEMBLED, That in order to promote the highest use of public lands pending its final disposal, the Secretary of the Interior is authorized, in his discretion, by order to establish grazing districts or additions thereto and/or to modify the boundaries thereof of vacant, unappropriated, and unreserved lands from any part of the public domain of the United States (exclusive of Alaska), which are not in national forests, national parks and monuments, Indian reservations, revested Oregon and California Railroad grant lands, or revested Coos Bay Wagon Road grant lands, and which in his opinion are chiefly valuable for grazing and raising forage crops: PROVIDED, That no lands withdrawn or reserved for any other purpose shall be included in any such district except with the approval of the head of the department having jurisdiction thereof. Nothing in this Act shall be construed in any way to diminish, restrict, or impair any right which has been heretofore or may be hereafter initiated under existing law validly affecting the public lands, and which is maintained pursuant to such law except as otherwise expressly provided in this Act, nor to affect any land heretofore or hereafter surveyed which, except for the provisions of this Act, would be a part of any grant to any State, nor as limiting or restricting the power or authority of any State as to matters within its jurisdiction. Whenever any grazing district is established pursuant to this Act, the Secretary shall grant to owners of land adjacent to such district, upon application of any such owner, such rights-of-way over the lands

included in such district for stock driving purposes as may be necessary for the convenient access by any such owner to marketing facilities or to lands not within such district owned by such person or upon which such person has stockgrazing rights. Neither this Act nor the Act of December 29, 1916 (39 Stat. 862; U.S.C., title 43, secs. 291 and following), commonly known as the "Stock Raising Homestead Act," shall be construed as limiting the authority or policy of Congress or the President to include in national forests public lands of the character described in section 24 of the Act of March 3, 1891 (26 Stat. 1103; U.S.C., title 16, sec. 471), as amended, for the purposes set forth in the Act of June 4, 1897 (30 Stat. 35; U.S.C., title 16, sec. 475), or such other purposes as Congress may specify. Before grazing districts are created in any State as herein provided, a hearing shall be held in the State, after public notice thereof shall have been given, at such location convenient for the attendance of State officials, and the settlers, residents, and livestock owners of the vicinity, as may be determined by the Secretary of the Interior. No such district shall be established until the expiration of ninety days after such notice shall have been given, nor until twenty days after such hearing shall be held: PROVIDED, HOWEVER, That the publication of such notice shall have the effect of withdrawing all public lands within the exterior boundary of such proposed grazing districts from all forms of entry or settlement. Nothing in this Act shall be construed as in any way altering or restricting the right to hunt or fish within a grazing district in accordance with the laws of the United States or of any State, or as vesting in any permittee any right whatsoever to interfere with hunting or fishing within a grazing district. (43 U.S.C., sec. 315)

SEC. 2. The Secretary of the Interior shall make provision for the protection, administration, regulation, and improvement of such grazing districts as may be created under the authority of the foregoing section, and he shall make such rules and regulations and establish such service, enter into such cooperative agreements, and do any and all things necessary to accomplish the purposes of this Act and to insure the objects of such grazing districts, namely to regulate their occupancy and use, to preserve the land and its resources from destruction or unnecessary injury, to provide for the orderly use, improvement, and development of the range; and the Secretary of the Interior is authorized to continue the study of erosion and flood control and to perform such work as may be necessary amply to protect and rehabilitate the areas subject to the provisions of this Act, through such funds as may be made available for that purpose, and any willful violation of the provisions of this Act or of such rules and regulations thereunder after actual notice thereof shall be punishable by a fine of not more than $500. (43 U.S.C., sec. 315a)

SEC. 3. The Secretary of the Interior is authorized to issue or cause to be issued permits to graze livestock on such grazing districts to such bona fide settlers, residents, and other stock owners as under his rules and regulations are entitled to participate in the use of the range, upon the payment annually of reasonable fees in each case to be fixed or determined from time to time, and in fixing the amount of such fees the Secretary of the Interior shall take into account the extent to which such districts yield public benefits over and above those accruing to the users of the forage resources for livestock purposes. Such fees shall consist of a grazing fee for the use of the range, and a range-improvement fee which, when appropriated by the Congress, shall be available until expended solely for the construction, purchase, or maintenance of range improvement. Grazing permits shall be issued only to citizens of the United States or to those who have filed the necessary declarations of intention to become such, as required by the naturalization laws, and to groups, associations, or corporations authorized to conduct business under the laws of the State in which the grazing district is located. Preference shall be given in the issuance of grazing permits to those within or near a district who are landowners engaged in the livestock business, bona fide occupants or settlers, or owners of water or water rights, as may be necessary to permit the proper use of lands, water, or water rights owned, occupied, or leased by them, except that until July 1, 1935, no preference shall be given in the issuance of such permits to any such owner, occupant, or settler, whose rights were acquired between January 1, 1934, and December 31, 1934, both dates inclusive, except that no permittee complying with the rules and regulations laid down by the Secretary of the Interior shall be denied the renewal of such permit, if such denial will impair the value of the grazing unit of the permittee, when such unit is pledged as security for any bona fide loan. Such permits shall be for a period of not more than ten years, subject to the preference right of the permittees to renewal in the discretion of the Secretary of the Interior, who shall specify from time to time numbers of stock and seasons of use. During periods of range depletion due to severe drought or other natural causes, or in case of a general epidemic of disease, during the life of the permit, the Secretary of the Interior is authorized, in his discretion to remit, reduce, refund in whole or in part, or authorize postponement of payment of grazing fees for such depletion period so long as the emergency exists: PROVIDED FURTHER, That nothing in this

Act shall be construed or administered in any way to diminish or impair any right to the possession and use of water for mining, agriculture, manufacturing, or other purposes which has heretofore vested or accrued under existing law validly affecting the public lands or which may be hereafter initiated or acquired and maintained in accordance with such law. So far as consistent with the purposes and provisions of this Act, grazing privileges recognized and acknowledged shall be adequately safeguarded, but the creation of a grazing district or the issuance of a permit pursuant to the provisions of this Act shall not create any right, title, interest, or estate in or to the lands. (43 U.S.C., sec. 315b)

SEC. 4. Fences, wells, reservoirs, and other improvements necessary to the care and management of the permitted livestock may be constructed on the public lands within such grazing districts under permit issued by the authority of the Secretary, or under such cooperative arrangement as the Secretary may approve. Permittees shall be required by the Secretary of the Interior to comply with the provisions of law of the State within which the grazing district is located with respect to the cost and maintenance of partition fences. No permit shall be issued which shall entitle the permittee to the use of such improvements constructed and owned by a prior occupant until the applicant has paid to such prior occupant the reasonable value of such improvements to be determined under rules and regulations of the Secretary of the Interior. The decision of the Secretary in such cases is to be final and conclusive. (43 U.S.C., sec. 315c)

SEC. 5. The Secretary of the Interior shall permit, under regulations to be prescribed by him, the free grazing within such districts of livestock kept for domestic purposes; and provided that so far as authorized by existing law or laws hereinafter enacted, nothing herein contained shall prevent the use of timber, stone, gravel, clay, coal, and other deposits by miners, prospectors for mineral, bona fide settlers and residents, for firewood, fencing, buildings, mining, prospecting, and domestic purposes within areas subject to the provisions of this Act. (43 U.S.C., sec. 315d)

SEC. 6. Nothing herein contained shall restrict the acquisition, granting, or use of permits or rights-of-way within grazing districts under existing law; or ingress or egress over the public lands in such districts for all proper and lawful purposes; and nothing herein contained shall restrict prospecting, locating, developing, mining, entering, leasing, or patenting the mineral resources of such districts under law applicable thereto. (43 U.S.C., sec. 315e)

SEC. 7. The Secretary of the Interior is hereby authorized in his discretion, to examine and classify any lands, withdrawn or reserved by Executive Order of November 26, 1934 (numbered 6910), and amendments thereto, and Executive Order of February 5, 1935 (numbered 6964), or within a grazing district, which are more valuable or suitable for the production of agricultural crops than for the production of native grasses and forage plants, or more valuable or suitable for any other use than for the use provided for under this Act, or proper for acquisition in satisfaction of any outstanding lieu, exchange or script rights or land grant, and to open such lands to entry, selection, or location for disposal in accordance with such classification under applicable public-land laws, except that homestead entries shall not be allowed for tracts exceeding three hundred and twenty acres in area. Such lands shall not be subject to disposition, settlement, or occupation until after the same have been classified and opened to entry: PROVIDED, That locations and entries under the mining laws, including the Act of February 25, 1920, as amended, may be made upon such withdrawn and reserved areas without regard to classification and without restrictions or limitation by any provision of this Act. Where such lands are located within grazing districts reasonable notice shall be given by the Secretary of the Interior to any grazing permittee of such lands. The applicant, after his entry, selection, or location is allowed, shall be entitled to the possession and use of such lands: PROVIDED, That upon the application of any applicant qualified to make entry, selection, or location, under the public-land laws, filed in the land office of the proper district, the Secretary of the Interior shall cause any tract to be classified, and such application, if allowed by the Secretary of the Interior, shall entitle the applicant to a preference right to enter, select, or locate such lands if opened to entry as herein provided. (43 U.S.C., Sec. 315f)

SEC. 8. (a) Where such action will promote the purposes of a district or facilitate the administration of the public lands, the Secretary is authorized to accept on behalf of the United States any lands within or without the exterior boundaries of a grazing district as a gift.

(b) When public interest will be benefited thereby, the Secretary is authorized to accept on behalf of the United States title to any privately owned lands within or without the boundaries of a grazing district, and in exchange therefor to issue a patent for not to exceed an equal value of surveyed grazing district land or of unreserved surveyed public land in the same State or within a distance of not more than fifty miles within the adjoining State nearest the base lands.

(c) Upon application of any State to exchange lands within or without the boundaries of a grazing district the Secretary of the Interior shall, and is hereby, directed to proceed with such exchange at the earliest practicable date and to cooperate fully with the State to that end, but no State shall be permitted to select lieu lands in another State. The Secretary of the Interior shall accept on behalf of the United States title to any State-owned lands within or without the boundaries of a grazing district, and in exchange therefor issue patent to surveyed grazing district land not otherwise reserved or appropriated or unappropriated and unreserved surveyed public land; and in making such exchange the Secretary is authorized to patent to such State, land either of equal value or of equal acreage: PROVIDED, That no State shall select public lands in a grazing district in furtherance of any exchange unless the lands offered by the State in such exchange lie within such grazing district and the selected lands lie in a reasonably compact body which is so located as not to interfere with the administration or value of the remaining land in such district for grazing purposes as set forth in this Act.

When an exchange is based on lands of equal acreage and the selected lands are mineral in character, the patent thereto shall contain a reservation of all minerals to the United States; and in making exchanges of equal acreage the Secretary of the Interior is authorized to accept title to offered lands which are mineral in character, with a mineral reservation to the State.

For the purpose of effecting exchanges based on lands of equal acreage the identification and area of unsurveyed school sections may be determined by protraction or otherwise. The selection by the State of lands in lieu of any such protracted school sections shall be a waiver of all of its right to such sections.

(d) Before any such exchange under this section shall be effected, notice of the contemplated exchange, describing the lands involved, shall be published by the Secretary of the Interior once each week for four successive weeks in some newspaper of general circulation in the county or counties in which may be situated the lands to be accepted, and in the same manner in some like newspaper published in any county in which may be situated any lands to be given in such exchange; lands conveyed to the United States under this Act shall, upon acceptance of title, become public lands, and if located within the exterior boundaries of a grazing district they shall become a part of the district within the boundaries of which they are located: PROVIDED, That either party to an exchange based upon equal value under this section may make reservations of minerals, easements, or rights of use. Where reservations are made in lands conveyed either to or by the United States the right to enjoy them shall be subject to such reasonable conditions respecting ingress and egress and the use of the surface of the land as may be deemed necessary. Where mineral reservations are made by the grantor in lands conveyed by the United States, it shall be so stipulated in the patent, and any person who prospects for or acquires the right to mine and remove the reserved mineral deposits may enter and occupy so much of the surface as may be required for all purposes incident to the prospecting for, mining and removal of the minerals therefrom, and may mine and remove such minerals, upon payment to the owner of the surface for damages caused to the land and improvements thereon. No fee shall be charged for any exchange of land made under this Act except one-half of the cost of publishing notice of a proposed exchange as herein provided. (43 U.S.C., sec. 315g)

SEC. 9. The Secretary of the Interior shall provide, by suitable rules and regulations, for cooperation with local associations of stockmen, State land officials, and official State agencies engaged in conservation or propagation of wildlife interested in the use of the grazing districts. The Secretary of the Interior shall provide by appropriate rules and regulations for local hearings on appeals from the decisions of the administrative officer in charge in a manner similar to the procedure in the land department. The Secretary of the Interior shall also be empowered to accept contributions toward the administration, protection, and improvement of lands within or without the exterior boundaries of a grazing district, moneys so received to be covered into the Treasury as a special fund, which is hereby appropriated and made available until expended, as the Secretary of the Interior may direct, for payment of expenses incident to said administration, protection, and improvement, and for refunds to depositors of amounts contributed by them in excess of their share of the cost. (43 U.S.C., sec. 315h)

SEC. 10. Except as provided in sections 9 and 11 hereof, all moneys received under the authority of this Act shall be deposited in the Treasury of the United States as miscellaneous receipts, but the following proportions of the moneys so received shall be distributed as follows: (a) 12½ per centum of the moneys collected as grazing fees under section 3 of this Act during any fiscal year shall be paid at the end thereof by the Secretary of the Treasury to the State in which the grazing districts producing such moneys are situated, to be expended as the State legislature of such State may prescribe for the benefit of the county or counties in which the grazing districts producing such moneys are situated: PROVIDED, That if any grazing district is in more than one State or county, the dis-

tributive share to each from the proceeds of said district shall be proportional to its area in said district; (b) 25 per centum of all moneys collected under section 15 of this Act during any fiscal year when appropriated by the Congress, shall be available until expended solely for the construction, purchase, or maintenance of range improvements; and 50 per centum of all moneys collected under section 15 of this Act during any fiscal year shall be paid at the end thereof by the Secretary of the Treasury to the State in which the lands producing such moneys are located, to be expended as the State legislature of such State may prescribe for the benefit of the county or counties in which the lands producing such moneys are located: PROVIDED, That if any leased tract is in more than one State or county, the distributive share to each from the proceeds of said leased tract shall be proportional to its area in said leased tract. (43 U.S.C., sec. 315i)

SEC. 11. That when appropriated by Congress, 33⅓ per centum of all grazing fees received from each grazing district on Indian lands ceded to the United States for disposition under the public-land laws during any fiscal year shall be paid at the end thereof by the Secretary of the Treasury to the State in which said lands are situated, to be expended as the State legislature may prescribe for the benefit of public schools and public roads of the county or counties in which such grazing lands are situated. And the remaining 66⅔ per centum of all grazing fees received from such grazing lands shall be deposited to the credit of the Indians pending final disposition under applicable laws, treaties, or agreements. The applicable public-land laws as to said Indian ceded lands within a district created under this Act shall continue in operation, except that each and every application for nonmineral title to said lands in a district created under this Act shall be allowed only if in the opinion of the Secretary of the Interior the land is of the character suited to disposal through the Act under which application is made and such entry and disposal will not affect adversely the best public interest, but no settlement or occupation of such lands shall be permitted until ninety days after allowance of an application. (43 U.S.C., sec. 315j)

SEC. 12. That the Secretary of the Interior is hereby authorized to cooperate with any department of the Government in carrying out the purposes of this Act, and in the coordination of range administration, particularly where the same stock graze part time in a grazing district and part time in a national forest or other reservation. (43 U.S.C., sec. 315k)

SEC. 13. That the President of the United States is authorized to reserve by proclamation and place under national-forest administration in any State where national forests may be created or enlarged by Executive Order any unappropriated public lands lying within watersheds forming a part of the national forests which, in his opinion, can best be administered in connection with existing national-forest administration units, and to place under the Interior Department administration any lands within national forests, principally valuable for grazing, which, in his opinion can best be administered under the provisions of this Act: PROVIDED, That such reservations or transfers shall not interfere with legal rights, acquired under any public-land laws so long as such rights are legally maintained. Lands placed under the national-forest administration under the authority of this Act shall be subject to all the laws and regulations relating to national forests, and lands placed under the Interior Department administration shall be subject to all public-land laws and regulations applicable to grazing districts created under authority of this Act. Nothing in this section shall be construed so as to limit the powers of the President (relating to reorganizations in the Executive departments) granted by title 4 of the Act entitled "An Act making appropriations for the Treasury and Post Office Departments for the fiscal year ending June 30, 1934, and for other purposes", approved March 3, 1933. (43 U.S.C., sec. 315 l)

SEC. 14. That section 2455 of the Revised Statutes, as amended, is amended to read as follows:

> "SEC. 2455. Notwithstanding the provisions of section 2357 of the Revised Statutes (U.S.C., title 43, sec. 678) and of the Act of August 30, 1890 (26 Stat. 391), it shall be lawful for the Secretary of the Interior to order into market and sell at public auction, at the land office of the district in which the land is situated for not less than the appraised value, any isolated or disconnected tract or parcel of the public domain not exceeding one thousand five hundred and twenty acres which, in his judgment, it would be proper to expose for sale after at least thirty days' notice by the land office of the district in which such land may be situated: PROVIDED, That for a period of not less than thirty days after the highest bid has been received, any owner or owners of contiguous land shall have a preference right to buy the offered lands at such highest bid price, and where two or more persons apply to exercise such preference right the Secretary of the Interior is authorized to make an equitable division of the land among such applicants, but in no case shall the adjacent land owner or owners be required to pay more than three times the appraised price: PROVIDED FURTHER, That any legal subdivisions of the public land, not exceeding seven hundred and sixty acres, the greater part of which is mountainous or too rough for cultivation, may, in the discretion of the said Secretary, be ordered into the market and sold pursuant to this section upon the application of any person who owns land or holds a valid entry of lands adjoining such tract, regardless of the fact that such tract may not be isolated or disconnected within the meaning of this section: PROVIDED FURTHER, That this section shall not defeat any valid right which has already attached under any pending entry

or location. The word 'person' in this section shall be deemed to include corporations, partnerships, and associations." (43 U.S.C. sec. 1171)

SEC. 15. The Secretary of the Interior is further authorized, in his discretion, where vacant, unappropriated, and unreserved lands of the public domain are so situated as not to justify their inclusion in any grazing district to be established pursuant to this Act, to lease any such lands for grazing purposes, upon such terms and conditions as the Secretary may prescribe: PROVIDED, That preference shall be given to owners, homesteaders, lessees, or other lawful occupants of contiguous lands to the extent necessary to permit proper use of such contiguous lands, except that when such isolated or disconnected tracts embrace seven hundred and sixty acres or less, the owners, homesteaders, lessees, or other lawful occupants of lands contiguous thereto or cornering thereon shall have a preference right to lease the whole of such tract, during a period of ninety days after such tract is offered for lease, upon the terms and conditions prescribed by the Secretary: PROVIDED FURTHER, That when public lands are restored from a withdrawal, the Secretary may grant an appropriate preference right for a grazing lease, license, or permit to users of the land for grazing purposes under authority of the agency which had jurisdiction over the lands immediately prior to the time of their restoration. (43 U.S.C., sec. 315m)

SEC. 16. Nothing in this Act shall be construed as restricting the respective States from enforcing any and all statutes enacted for police regulation, nor shall the police power of the respective States be, by this Act, impaired or restricted, and all laws heretofore enacted by the respective States or any thereof, or that may hereafter be enacted as regards public health or public welfare, shall at all times be in full force and effect: PROVIDED, HOWEVER, That nothing in this section shall be construed as limiting or restricting the power and authority of the United States. (43 U.S.C., sec. 315n)

SEC. 17. Superseded by 1946 Reorganization Plan No. 3, sec. 403, effective July 16, 1946 (11 F.R. 7876, 60 Stat. 1100). (43 U.S.C., sec. 315o)

SEC. 18. (a) In order that the Secretary of the Interior may have the benefit of the fullest information and advice concerning physical, economic, and other local conditions in the several grazing districts, there shall be an advisory board of local stockmen in each such district, the members of which shall be known as grazing district advisers. Each such board shall consist of not less than five nor more than twelve members, exclusive of wildlife representatives, one such representative to be appointed by the Secretary, in his discretion, to membership on each such board. Except for such wildlife representatives, the names of the members of each district advisory board shall be recommended to the Secretary by the users of the range in that district through an election conducted under rules and regulations prescribed by the Secretary. No grazing district adviser so recommended, however, shall assume office until he has been appointed by the Secretary and has taken an oath of office. The Secretary may, after due notice, remove any grazing district adviser from office if in his opinion such removal would be for the good of the service.

(b) Each district advisory board shall meet at least once annually at a time to be fixed by the Secretary of the Interior, or by such other officer to whom the Secretary may delegate the function of issuing grazing permits, and at such other times as its members may be called by such officer. Each board shall offer advice and make recommendation on each application for such a grazing permit within its district: PROVIDED, That in no case shall any grazing district adviser participate in any advice or recommendation concerning a permit, or an application therefor, in which he is directly or indirectly interested. Each board shall further offer advice or make recommendations concerning rules and regulations for the administration of this Act, the establishment of grazing districts and the modification of the boundaries thereof, the seasons of use and carrying capacity of the range, and any other matters affecting the administration of this Act within the district. Except in a case where in the judgment of the Secretary an emergency shall exist, the Secretary shall request the advice of the advisory board in advance of the promulgation of any rules and regulations affecting the district. (43 U.S.C., sec. 315o–1)

BACKGROUND OF ECONOMIC ANALYSIS

Assumptions and Background

In order to assess the economic impact of the livestock grazing management program and major alternatives, it will be necessary to assume alternative levels of AUM production for NRL.

1. Livestock Grazing Management Program: A 3.5 million AUM increase by the year 2000 and a 5.2 million AUM increase by 2010, allocated to each biome on the basis of livestock trends.

2. Alternative A: Five percent decline over a 20-year period affecting all regions.

3. Alternative B: Zero AUM production from NRL.

4. Alternative C: Seventy-three percent increase in accordance with estimates made by the PLLRC.

5. Alternative D: The same AUM production and economic effects could be expected as with the livestock grazing management program, except they would occur 10 years earlier.

6. Alternative E: Same as Alternative A except decline would be over a 30 to 35 year period.

In assessing the economic impacts of the livestock grazing management program and major alternatives, the basic approach was to select a method of analysis which was as similar as possible to the methods used in assessing impacts upon the physical environment. Therefore, no attempt has been made to prove value or determine the feasibility of an alternative, rather the estimated impacts on income flows was selected as a means of displaying impacts on a major portion of the human environment.

In general, such impacts appear small in large areas and may become progressively more significant as the geographic areas or economic unit is reduced in size. For example, earnings from the livestock industry in 1970 accounted for about 1 percent of the total personal income of the 11 Western States and the contribution of NRL to livestock industry earnings is estimated at only slightly more than 1 percent. On the other hand, in eastern Montana, nearly 10 percent of personal income is earned in the livestock industry and about 7 percent of the industry earnings is attributable to the NRL. Of course, on an individual basis, the dependency on NRL ranges from zero to nearly 100 percent.

All aspects of economic importance are not always measured by single indicators such as income. For example, some operators may be completely dependent on NRL for livestock feed during a short period of the year, for which it may be economically ruinous to substitute alternative feed sources such as hay. In certain regions, notably the hot desert areas of California and Arizona, the livestock industry is heavily influenced by feedlot operations which are not directly dependent at all on NRL, yet no cattle are bred and raised in such operations and therefore the importance of grazing to the industry is not completely reflected in percentage ratios of income.

Notwithstanding the above considerations, income flow estimates are sufficiently indicative of impacts at the biome level to be compatible with indications of physical and biological impacts identified for the same areas. The reader is cautioned not to compare annual income effects to program cost estimates in the sense of a benefit-cost ratio. For example, the total annual income effect of the livestock grazing management program is estimated at around $20 million; this flow of income, in 1970 dollars, would come into being when the management program was fully implemented and would continue as long as the program remained operative. This income flow measures the impact on regional economies within the environment being analyzed. Costs, on the other hand, are of two types: (a) development expenses which occur for only a few years, and (b) supervisory management costs extending over the life of the program. Since these costs are not assessed against the resulting income, their impacts on the environment in question cannot be established. Comparison of returns and expenses is a test of economic feasibility and not of impact. All such considerations of feasibility are more properly addressed to specific projects and procedures outside of environmental impact statements.

Tables III-A-1 and 2 summarize basic economic relationships and estimated impacts of the livestock grazing management program and major alternatives.

Table III-A-1: Livestock Earnings, National Resource Lands and Livestock Feed by Biome; 1970

	Grassland Biome	Desert Biome [a]	Woodland-Bushland Biome [b]	Coniferous Forest Biome
Earnings from Livestock Indus. ($1,000's)	500,000	360,000	80,000	180,000
Livestock Earnings as % of Personal Income	2.9	2.3	0.1	0.8
NRL Acres	18,080,000	132,720,000	700,000	20,070,000
as % of Total Area	8.0	42.9	3.6	10.2
Beef Cattle AUM's from NRL	2,890,000	6,190,000	20,000	1,110,000
as % of Total Feed	2.9	9.8	0.2	2.3
Sheep AUM's from NRL	500,000	1,920,000	4,000	250,000
as % of Total Feed	5.7	23.2	0.5	4.0

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[a] Includes approximately 30 million acres of woodland-bushland biome.

[b] Includes only the California coastal region south of San Francisco.

Table III-A-2: Summary of Estimated Income Effects
Of Livestock Grazing Management Program and Major Alternatives
By Biome and Total

	Grassland Biome	Desert Biome [a]	Woodland-Bushland Biome [b]	Coniferous Forest Biome	Total 11 Western States [c]
Total Personal Income ($1,000's)	17,512,000	15,599,000	59,517,000	21,801,000	114,429,000
Livestock Ind. Earnings ($1,000's)	501,000	355,000	80,000	184,000	1,120,000
Est. Ann. Earnings Eff. of the Livestock Grazing Management Program ($1,000's)	4,300	7,400	[d]	1,100	13,000
Est. Total Ann. Income Eff. of the Livestock Grazing Management Program [e] ($1,000's)	6,400	12,100	[d]	1,800	20,000
Est. Total Ann. Income Eff. of Alternative A&E ($1,000's) [e]	-900	-1,700	[d]	-300	-3,000
Est. Total Ann. Income Eff. of Alternative B [e] ($1,000's)	-20,400	-44,300	-200	-7,200	-72,000
Est. Total Ann. Income Eff. of Alternative C ($1,000's)	44,600	58,400	600	11,000	115,000

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[a] Includes approximately 30 million acres of woodland-bushland biome.
[b] Includes only California coastal portion.
[c] May not add due to rounding.
[d] Too small to estimate.
[e] Includes multiplier effect in regional economies.

Demand Analysis

With respect to demand for forage products from grazing lands, the following has been abstracted from Forest Resource Report No. 19, USDA:[1/]

The state of the Nation's economy will influence the management and use of the range environment. The economic situation on which projected needs and opportunities for management of the range environment are based, is briefly outlined here.

The projected population of 281 million people in the year 2000 is about 1.3 times the 1970 population. The general economy is assumed to remain stable and productive. Production value per man-hour in the year 2000 will be nearly two and one-half times what it was in 1970. The economy is expected to yield a Gross National Product (GNP) of $1,152 billion in 1980 and of $2,350 billion in 2000. The GNP will more than double in the 20 years between 1960 and 1980, and will increase by more than five times between 1980 and 2000....

Foreign trade in livestock products is a potentially important variable, and revisions of import and export policies could lead to increases or decreases in total domestic production. Nonetheless, it has been assumed that foreign policy will not undergo a major change....

Grazing of livestock (expressed here in animal unit months) is an intermediate output from range. Range livestock production, operating within the context of total production of livestock, will share the fate of the rest of agriculture. Consideration, therefore, is given to the outlook for livestock production and its implications for grazing.

Projected growth in population and income will continue to expand markets for farm products. Rising incomes will permit shifts in the composition of human diets. More foods of higher value, such as meat, will be consumed. Despite alternative sources of protein for human diets, livestock products will continue to be important to both the farmer and the consumer during the next two decades.

Consumption of lamb and mutton, pork, eggs, and dairy products has declined recently, but consumption of poultry and beef has increased substantially. Preference for beef is expected to continue to increase.

1/ USDA, The Nation's Range Resources, Forest Resource Report No. 19-1972.

The annual per capita consumption of pounds of selected meat by civilians for specified periods and expected in 1980 and 2000 is as follows:

	Actually Consumed			Projected	
	1947-49	1957-59	1963-65	1980	2000
Beef and veal	75.3	89.2	102.9	130.0	135.0
Lamb and mutton	4.8	4.4	4.2	2.8	2.5

Veal declined from about 5 percent of total beef consumption in 1965 to about 3 percent in 1968, and it is expected to decline to about 2 percent by 1980 and to about 1 percent by the year 2000.

Per capita consumption of wool is expected to decline slightly, but total consumption will increase because of population growth, as shown in the following tabulation:

	1965	1980	2000
Wool consumption per capita, pounds	2.0	1.9	1.8
Total consumption of wool, million lbs.	387	447	554

The United States has substantial net imports of lamb and mutton, wool, and sheepskins. About 70 to 75 percent of our wool is imported, and we get up to 20 percent of our lamb and mutton from other countries. Thus, continuing preference for beef over lamb and mutton, and the impacts of imports, indicate further reduction of the domestic production of sheep.

Much of the increased demand for beef has been met by extending and intensifying operations in feedlots. In the 1950's large numbers of cattle and some lambs went directly to slaughter from range or pastures. Now, fewer cattle are slaughtered as "grassfat," and an increasing share of meat production is from concentrates in feedlots.

The trend toward fattening beef in feedlots, coupled with a decline in dairy herds, has resulted in a relatively short domestic supply of lean beef. Imports have made up the difference. Imports of beef approximated 9 percent of domestic production in 1968. On the other hand, exports commonly are less than 1 percent of domestic production.

American agriculture has the capacity to respond to the projected increased demands for meat and will respond if price relationships are favorable. This capacity to respond has been demonstrated. Between 1960 and 1968 beef production increased 41 percent. This increase, along with a doubling of beef imports, provided beef for an 11 percent increase in population and for the increasing preference by consumers for beef over other meats....

In the face of the changing technology of beef production and apparent untapped productivity of pasture forage and other feed production sources, it might appear that range may not be "needed" for livestock production. No doubt it is possible that other feeds and feed sources have the potential to provide the feed now supplied by grazing the range....

There are other indicators that suggest continued high demand over the next 10 to 20 years for use of the nation's range resources for forest-range livestock grazing. Historically, cattle and sheep have been the principal marketable outputs of range ecosystems. The most consistent feature of the historic role of the range has been its use as a low-cost feed source. Furthermore, many rural economies are substantially dependent on production of livestock from range ecosystems. Increasing the production of range livestock may help strengthen these local or regional economies.

Range lands can compete as they do now in providing the additional feeder cattle needed in the next 10 to 20 years if range costs do not increase relative to other feed sources. Competition among regions of the nation will partly reflect availability of land and relative costs for raising feeder cattle. Range will continue to support domestic production of lambs and wool....

The results obtained in estimating the demand for forest-range grazing, when compared to other similar studies, appear reasonable. In summary, the projections were derived in the following manner:

Projected population times projected per capita consumption of meat, plus other uses, results in total domestic consumption of beef and mutton. Per capita consumption was derived within a context of total food consumption including other meats, and as modified by changes in income and taste preferences.

Total domestic consumption of beef and mutton was further modified by the consideration of beef and mutton imports and exports. Thus, a total domestic production of beef and mutton was estimated.

Domestic production times the quantity of feed required per pound of meat produced indicated the total feed requirements and the particular mix of feeds included in these requirements. The total feed and feed mix was then modified by expected changes in the structure of beef industry, feed conversion efficiency, livestock breeding, production in feed lots, quality of feeds, knowledge of livestock diet needs, and production capabilities of various feeds.

The computed result is an indication of the total grazing requirement. The total grazing requirement was then divided between grazing of improved pastures and grazing of the forest-range environment.

These grazing requirements of the forest-range environment were used to compute an index. The index was applied to the production of animal unit months in 1970...., in order to project production requirements for grazing in 1980 and 2000 from forest-range.

In addition, a long-range target was estimated for the year 2020. The resulting levels for grazing from the forest-range environment were:

	1970	1980	2000	2020
Index	100	120	150	185
AUM's millions	213	256	320	394

The above AUM demand projection is for the total grazing industry, regardless of land ownership. If the NRL were to provide the same proportion of AUM's in the future as in 1970, a 50 percent increase would be needed by the year 2000, and a 68 percent increase over 1970 levels would be needed by 2010. However, the livestock grazing management program would provide considerably lower levels of AUM production from NRL. Only Alternative C, maximum production, would meet projected demand in 2010, and even this alternative would fall short of 2020 projections. The implication is that either AUM production will shift proportionately to other sources of supply, or the price of livestock and livestock products will rise relative to general prices over the projected period.

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